S. Hrg. 98-714

ACiD RAIN, 1984

HEARINGS

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

FEBRUARY 2, 7, 9, AND 10, 1984

Printed for the use of the Committee on Environment and Public Works

5 321-22

U.S. GOVERNMENT PRINTING OFFICE
32-304 O WASHINGTON : 1984

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ROBERT T. STAFFORD, Vermont, *Chairman*

HOWARD H. BAKER, Jr., Tennessee
JOHN H. CHAFEE, Rhode Island
ALAN K. SIMPSON, Wyoming
JAMES ABDNOR, South Dakota
STEVE SYMMS, Idaho
PETE V. DOMENICI, New Mexico
DAVE DURENBERGER, Minnesota
GORDON J. HUMPHREY, New Hampshire
DANIEL J. EVANS, Washington

JENNINGS RANDOLPH, West Virginia
LLOYD BENTSEN, Texas
QUENTIN N. BURDICK, North Dakota
GARY HART, Colorado
DANIEL PATRICK MOYNIHAN, New York
GEORGE J. MITCHELL, Maine
MAX BAUCUS, Montana
FRANK R. LAUTENBERG, New Jersey

Bailey Guard, *Staff Director*
John W. Yago, Jr., *Minority Staff Director*

CONTENTS

February 2, 1984

OPENING STATEMENTS

Page

Abdnor, Hon. James, U.S. Senator from the State of South Dakota 7
Chafee, Hon. John H., U.S. Senator from the State of Rhode Island 3
Durenberger, Hon. Dave, U.S. Senator from the State of Minnesota 40
Mitchell, Hon. George J., U.S. Senator from the State of Maine 6
Moynihan, Hon. Daniel Patrick, U.S. Senator from the State of New York 5
Randolph, Hon. Jennings, U.S. Senator from the State of West Virginia 7
Simpson, Hon. Alan K., U.S. Senator from the State of Wyoming 44
Stafford, Hon. Robert T., U.S. Senator from the State of Vermont 1
Symms, Hon. Steve, U.S. Senator from the State of Idaho 8

WITNESSES

Ruckelshaus, William D., Administrator, Environmental Protection Agency 9

ADDITIONAL MATERIAL

Citizens' Conference To Stop Acid Rain, platform of 33

February 7, 1984 (p. 69)

OPENING STATEMENTS

Baucus, Hon. Max, U.S. Senator from the State of Montana 70
Moynihan, Hon. Daniel Patrick, U.S. Senator from the State of New York 70
Stafford, Hon. Robert T., U.S. Senator from the State of Vermont 69

WITNESSES

Cowling, Dr. Ellis, professor, North Carolina State University; and Dr. Arthur Johnson, professor, University of Pennsylvania 107
  Written statements 158, 202
Danforth, Hon. John C., U.S. Senator from the State of Missouri 71
  Written statement 115
  Amendment to S. 768 122
Matheson, Hon. Scott, Governor, State of Utah 84
  Written statement 133
Perpich, Rudy, Governor, State of Minnesota 87
  Written statement 145
Schwinden, Hon. Ted, Governor, State of Montana 92
  Written statement 153
Sununu, Hon. John H., Governor, State of New Hampshire 79
  Written statement 127

ADDITIONAL MATERIAL

ICF, Inc., "Analysis of Coal Production and Employment Impacts of the Waxman-Sikorski Bill and a Cost-Effective Equivalent" 207

FEBRUARY 9, 1984 (p. 225)

OPENING STATEMENTS

Page
Baucus, Hon. Max, U.S. Senator from the State of Montana 244, 272
Stafford, Hon. Robert T., U.S. Senator from the State of Vermont 225

WITNESSES

Bagge, Carl E., president, National Coal Association 260
  Written statement 424
  Responses to questions from Senator Mitchell 433
D'Amato, Hon. Alfonse M., U.S. Senator from the State of New York 226
Dean, Charles H., Jr., chairman, board of directors, Tennessee Valley Authority, accompanied by S. David Freeman, director, and Richard M. Freeman, director 237
  Written statement 285
  Responses to additional questions 338
Dukakis, Hon. Michael D., Governor, State of Massachusetts 227
  Written statement 282
Dysart, Benjamin, president, National Wildlife Federation, accompanied by Ken Kamlet, director, pollution and toxic substances division, National Wildlife Federation, and Richard Ayres, chairman, National Clean Air Coalition 263
  Written statement 443
Gonze, Ruth, assistant legislative director, American Public Power Association, accompanied by Michael Bergman, APPA staff scientist 255
  Written statement 365
Harrison, William B., senior vice president, Southern Company Services Inc., on behalf of the Edison Electric Institute 257
  Written statement 382
  Letter to Senator Mitchell 405
  Letter to Senator Stafford 415
McCormick, William T., Jr., president, American Natural Resources Co., Detroit, Mich., speaking on behalf of Alliance for Clean Energy 250
  Written statement 342
Munzer, Dr. Alfred, chairman, Government Relations Committee, American Lung Association 253
  Written statement 354

FEBRUARY 10, 1984 (p. 489)

WITNESSES

Abele, Ralph, executive director, Pennsylvania Fish Commission and chairman, Acid Precipitation Committee, International Association of Fish & Wildlife Agencies 524
  Written statement 710
Altmeyer, Thomas, vice president, congressional affairs, Mining & Reclamation Council of America 507
  Written statement 641
Anderson, Kurt, environmental affairs manager, New York Power Pool 518
  Written statement 684
Ayres, Richard E., chairman, National Clean Air Coalition 509
Buchanan, Harry W., vice president, Celenese Corp 496
  Written statement 557
Davis, George D., executive director, the Adirondack Council, Elizabethtown, N.Y 493
  Written statement 539
Gonick, Ely, senior vice president for technology, International Paper Co 504
  Written statement 628
Green, Leon, Jr., vice president, Clean Coal Coalition, Washington, D.C., accompanied by Michael J. Zimmer, legal counsel to the coalition 498
  Written statement 565
Holmes, Julia, action director, League of Women Voters of the United States 505
Hutchcraft, A. Stephen, president, Kaiser Aluminum & Chemical Corp., on behalf of the Aluminum Association, Inc 489
  Written statement 531

Page
Karis, William G., vice president, corporate planning, Consolidation Coal Co.... 501
Written statement ... 581
Kennedy, Jay B., executive director, Electricity Consumers Resource Council .. 502
Written statement ... 620
Lawrence, George H., president, American Gas Association ... 495
Written statement ... 544
Quarles, John, attorney at law, on behalf of the National Environmental Development Association, Clean Air Act Project ... 513
Written statement ... 653
Scahill, James, executive vice president, Pennsylvania Coal Mining Association, accompanied by Wilson Fisher, technical committee chairman ... 522
Written statement ... 704
Sherry, Edward V., director, energy supply, Air Products & Chemicals, Inc., on behalf of National Association of Manufacturers ... 511
Written statement ... 645
Storey, Harry L., director of industry and legislative affairs, Anaconda Minerals Co., on behalf of the Western Regional Council ... 528
Written statement ... 723
Tostenson, Neal S., president, Ohio Mining & Reclamation Association ... 520
Written statement ... 696
Tuxill, Jacquelyn, chairperson, New Hampshire Citizens, Task Force on Acid Rain ... 516
Written statement ... 674
Wall, Evern, president and chief executive officer, El Paso Electric Co., on behalf of West Associates ... 526
Written statement ... 716
White, Thomas X., chairman, energy, environment and natural resources, National League of Cities ... 515
Written statement ... 666

ADDITIONAL MATERIAL

Frink, Charles R., vice director, The Connecticut Agricultural Experiment Station, article by ... 728

ACID RAIN, 1984

THURSDAY, FEBRUARY 2, 1984

U.S. Senate,
Committee on Environment and Public Works,
Washington, D.C.

The committee met at 9 a.m., in room SD-406, Dirksen Senate Office Building, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senators Stafford, Chafee, Simpson, Abdnor, Durenberger, Humphrey, Randolph, Burdick, Moynihan, Mitchell, and Baucus.

OPENING STATEMENT OF HON. ROBERT T. STAFFORD, U.S. SENATOR FROM THE STATE OF VERMONT

Senator Stafford. The Committee on Environment and Public Works will, please, come to order.

I welcome all of our guests this morning and my colleagues. I want those who are standing in the back of the room to know that we made strenuous efforts to get a larger hearing room but weren't able to do it. So we had to make do with the one that belongs to us.

This is the first appearance of William Ruckelshaus before this committee since his confirmation hearings on May 4 and 5, 1983. On behalf of the committee, I welcome you back, Mr. Administrator.

Today's hearing will deal with the problem of acid rain. Before we begin, I would like to share with you a few observations.

When Bill Ruckelshaus was nominated and confirmed last year, I and some other members of this committee hoped that action would result in a change in both the attitude and the policy of this administration on the subject of acid rain.

We were encouraged at Bill Ruckelshaus' swearing-in ceremony as administrator of the Environmental Protection Agency when the President placed high priority on the development of an acid rain strategy for the Nation.

By now we know that our hope and encouragement were without genuine foundation. Last year, the administration's policy on acid rain was more research. Today, the administration's policy on acid rain is more research, but at twice the price.

I am deeply disappointed.

I am disappointed first because the administration has chosen to continue its unrelenting opposition to any program designed to control acid rain.

I am disappointed also because there is every evidence that the administration has reaffirmed its policy of inaction for all of the wrong reasons.

I am disappointed because the administration has chosen to ignore the findings and recommendations of its own panel of science advisers as well as the findings of the National Academy of Sciences.

I am disappointed because the administration appears to be inconsiderate of the pleas of the people and the Government of Canada, one of our most loyal foreign friends.

Finally, I am disappointed because the administration continues to be insensitive to the plight of millions of Americans who live in a region of this great Nation that will continue to be victimized by acid rain unless action is taken—and taken soon—to control this pollution.

It has been reported that narrow forms of economics and of politics played an important role in the decision of this administration to ignore the need for an acid rain control program. Perhaps Mr. Ruckelshaus will be able to offer us sound evidence that it was otherwise.

I have heard and read enough of the assertions that it would cost $6,000 per fish for an acid rain control program, and that the addition involved in congressional or electoral votes is more important than the scientific facts regarding this form of air pollution.

There may be some in this room who believe that those strained and contorted interpretations lead to good public policy. I am not among those who believe that.

I have been involved in politics and in government service at the local, State, and Federal levels for virtually my entire adult life. Each of my colleagues on this committee and in the Congress is well aware of the political forces that ebb and flow across our Nation.

But, there is far more at stake in this debate than a few pickerel—or a few votes.

We are talking about our natural and manmade environments and about the health and well-being of the American people.

We are talking about fish, and trees, and crops, and buildings. Most importantly, we are talking about human health.

I know there are those who wince when I mention this—but it should never be far from our thoughts that this noxious mix of pollutants we are seeking to control does damage to the human body.

Some researchers estimate that as many as 50,000 Americans die unnecessarily each year because of air pollution. I know those estimates are controversial. And, I also know that there are those who dispute the validity of the studies on which they are based.

But, there are also many who argue that the number of Americans at risk is even higher. There can be no doubt that air pollution causes health damage to millions of Americans and reduces the quality of life for all of us at some time or another.

Each of us on this committee is well aware of the economic and political forces that are involved here. Indeed, we take those factors into consideration in virtually everything we do as we go about our chosen career in this art form of politics and self-government.

My State and my region of the country have much at stake in this debate. I do not deny my acute awareness of that condition. But, my position is not based on a parochial concern for my electorate.

I believe that acid rain exists because dozens of highly regarded scientists have told this committee that acid rain is real.

I believe that emissions from polluting smokestacks in the Midwest contribute to the acid rain that falls in New England and other parts of the Northeast because study after study has demonstrated that is the fact to be true beyond a reasonable doubt.

I believe that lakes and streams are, without any question, being damaged by acid rain because there is no longer any genuine scientific dispute over that circumstance.

Scientist after scientist and study after study have all come to the same conclusion.

There is some evidence that administrator Ruckelshaus reached his own conclusion that acid rain is real; that acid rain causes damage, and that acid rain controls should be initiated now.

All indications are that he reached that conclusion after an exhaustive study and review of the facts. That is exactly the way I expected he would make decisions when I voted to confirm his nomination last year. But he, of course, can speak for himself.

Perhaps his testimony here this morning will enlighten us all on how decisons regarding acid rain controls were reached at EPA and at the White House.

My high personal regard for Bill Ruckelshaus has not been diminished by recent events.

But, as a friend and supporter of his, I would be less than honest if I did not express a very serious concern.

I fear that the administration's most recent decision on acid-rain controls, and the manner in which that decision was reached, may severely damage the prospects that Mr. Ruckelshaus and the EPA will be able to regain the confidence of the American people that was lost just before he became Administrator.

Senator Chafee, do you have an opening statement?

OPENING STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator Chafee. Mr. Chairman, I do.

I would like to join in welcoming Mr. Ruckelshaus here this morning and I must say I don't envy his position, although I think we should bear in mind the old addage of don't kill the messenger if you don't like the message.

I think it is no secret that many of us who have been working for an acid rain bill over these years are deeply disappointed with the administration's decision to oppose an acid rain control strategy. And instead as we know from the President's message and other pronouncements from the administration they have opted for continued research and some band-aid type programs such as the suggestion of putting limestone into lakes in an attempt to revive them.

A year and a half ago, this committee voted by 15 to 1 to report a bill that would reduce sulfur-dioxide enissions by 8 million tons over a 12-year period. Some of us believe that that tonnage reduction was not enough. But we felt it was a feasible plan when all factors were taken into account. Since then the National Academy of Sciences completed a second report on this subject and reinforced its earlier conclusion, that not 8 million, not 10 million, but a 50-percent reduction equaling 12 million tons in reduction and sulfur dioxide is needed to clear acid rain.

In addition, in its first annual report to Congress, the Federal Government's interagency task force on acid rain found that manmade pollutants are probably the major contributors to acid rain in the Northeast.

In reviewing this report, the White House Office of Science and Policy said that postponing the reduction program until all desirable data is collected possibly in a matter of years, if not decades, entails an even greater risk of damage than if a plan were developed on imperfect data.

This problem isn't going to go away. It is spreading. Not only has the Northeast suffered the effects of acid rain, the U.S. Geological Survey recently reported that sulfate concentrations in streams have increased in the Southeast and West which suggests the beginnings of a regional acidification there.

Mr. Chairman, all of us are familiar with the devastating impact of acid rain. I don't think we have to go into that now. We have had hearings to that effect. We are going to learn more about it during the course of these hearings. But I would like to give you these thoughts as we move again, attempt to move forward to develop an acid rain proposal.

First, the major cause of acid rain does not rest with the States of the Northeast which suffer most from its ravages. We are being victimized by others, notably coal-fired powerplants located in the Midwest.

Undoubtedly it will cost a great deal of money to clean up the discharge of pollution from these plants. But those costs should be borne by those responsible.

It is no defense for the polluters to say that it is too expensive to clean up the problem. It seems to me that argument is akin to the homeowner who throws his garbage over a fence onto his neighbor's lawn, saying it is too expensive to have it hauled away.

The Northeast has a right to demand that the Midwest stop dumping its sulfur dioxide into our lakes and streams.

Second, it is not fair to ask the people of the Northeast to help pay the cost for ending acid rain. Those who live in our part of the country pay among the highest electric rates in the Nation in large part because of the clean fuels we require our utilities to burn.

Our citizens should not be asked to finance the cost of pollution control equipment on out-of-State utilities that provide lower cost electricity by the fact that they use cheaper but dirtier fuel.

Any acid rain reduction program should reward the clean States by requiring those who create the problem to help pay for its solution.

Finally, and Mr. Chairman, you touched on this in your statement, this is not just a problem of the Northeast. It is not just a national problem. This is becoming an international problem as well.

Certainly, we all know that a top priority of the Canadian Government is acid rain control. Canada is taking firm steps in reducing its emissions and indeed several Western European nations have instituted sulfur dioxide control strategy.

The United States is lagging behind in acid control. And this disturbs me because our country has had a proud record on environmental protection and we indeed have been a world leader in developing programs to combat all forms of pollution and we should continue to provide that leadership by instituting a comprehensive acid rain control program. So, Mr. Chairman, I look forward to these hearings and hearings from the Administrator and I really hope we can make sone progress this year.

Thank you.

Senator STAFFORD. Thank you, very much, Senator Chafee.

I join in that wish and hope for progress and we will work toward it.

Senator Moynihan.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator MOYNIHAN. Thank you, Mr. Chairman.

This is not going to be your greatest morning, Mr. Administrator, but it will give you better arguments when you go back where you have just come from. This committee is shaken, that after all we have done and all we have heard from you and hoped for from you we now have the President's response and we don't think it funny.

I would like to hear from you, when the time comes, that administration sources have said we counted electoral votes, not lives when we made the decision. We are serious about this subject and we have been at it a long time. We have been respectful of research.

I have been a member of the President's Science Advisory Committee. I have been a member of the Board of Directors of the National Association for the Advancement of Science, and I guess it is the case that the first legislation we adopted on this matter was authored by me, the Acid Rain Precipitation Act of 1980, and it began a research project but that research began accumulating at a very rapid rate.

That is what led this committee, just about 2½ years after the first act, by a 15-to-1 vote, as Senator Chafee has said, to propose an 8-million-ton reduction, a one-third reduction in sulfur dioxides in the Eastern United States and recognizing already that the problem was spreading. In the meantime, the research that has come in has strengthened the argument and made it a matter no longer of any serious scientific dispute.

The President's own acid deposition review panel has said and I quote:

> It is in the nature of the acid deposition problem that action has to be taken despite incomplete knowledge.

The panel then went on to say:

> If we take the conservative point of view that we must wait until the scientific knowledge is definitive, the accumulated deposition and damaged environment may reach the point of irreversability.

And you are talking about the irreversibility in the part of the country in which we live here and we are not about to see it damaged to the point where it cannot be undone because there are more electorial votes in the Ohio Valley.

This committee won't do that, sir. And we never expected that you would have to come here with the equivalent proposition and without knowing the great regard we have for you, I think it has to be said that your predecessors left this city in disgrace because they would not work with this committee on this subject. And we dare not see it happen with you.

We hold you in too great regard but in your testimony, I hope you will address the question, what did you propose to the President and the Office of Management and Budget? And what did you get back?

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you, Senator Moynihan.

Senator Mitchell.

OPENING STATEMENT OF HON. GEORGE J. MITCHELL, U.S. SENATOR FROM THE STATE OF MAINE

Senator MITCHELL. Thank you, Mr. Chairman.

Mr. Ruckelshaus, good morning. I join the other members of the committee in welcoming you here today. It was 9 months ago that you appeared before this committee at your nomination hearing. At that time I was impressed by your candor and we expect comparable candor from you today.

At that hearing you made a commitment to this committee and to the American people. You told us that you would evaluate all of the evidence available with respect to acid rain and base your recommendation on that evidence.

Today, we are confronted with essentially the same administration position on acid rain that existed in 1981, in 1982, and in 1983 before and after you assumed your present position.

We hope to learn from you today whether the President's position is consistent with your recommendation to him.

Senator Chafee has rightly pointed out that we should not shoot the messenger because the message is bad. If that is to be the case we are at least entitled to know the role which the messenger played in the shaping of the message.

The scientific support for significant acid-rain-control strategy has grown significantly in the past year, indeed in the time since you assumed office and it continues to grow. Yet the threshhold for action by the President has become a moving target that changes with each new scientific report.

I regret that very much. And I regret even more that all that has been accomplished on this issue since you were last before this committee is 9 more months of delay.

I look forward to exploring these issues with you today but I would also remind you that 18 months ago this committee approved overwhelmingly an acid-rain-control strategy.

I and other members of this committee are determined to do so once again with or without you and the President.

Senator STAFFORD. Thank you, Senator Mitchell.

Senator Humphrey.

Senator **Humphrey**. I will defer, Mr. Chairman, until Mr Ruckelshaus has had an opportunity to speak.

Senator **Stafford**. All right.

[Opening statements submitted for the record follow:]

OPENING STATEMENT OF HON. JAMES ABDNOR, U.S. SENATOR FROM THE STATE OF SOUTH DAKOTA

Mr. Chairman, I wish to join you in thanking Mr. Ruckelshaus for appearing before us today to discuss an issue of great concern.

While many of us may disagree as to what action, if any, is immediately warranted to control acid deposition, surely no one can dispute the fact that our rainfall is becoming increasingly acidic. Aquatic ecosystems in New England and Canada have been adversely affected—a disturbing number of lakes have already been destroyed. And the problem does not appear to be restricted to our lakes and streams. Researchers have testified before this committee that acid rain threatens also our forests, buildings and agricultural crops. It is now clear that this problem is not restricted to the Northeast—other areas of our Nation are noting increasingly acidic deposition. In my own State, the South Dakota Department of Water and Natural Resources reports that the acidity of rainfall in western South Dakota has increased in recent years.

However, even if we could agree that there is a serious problem which requires a legislative solution, developing a national consensus is no easy matter. This issue has pitted already region against region, and industry against industry. All the members of my party do not see eye-to-eye on the question of acid rain—neither do the members of the Senate's minority party. Proposed acid rain remedies are guaranteed to divide this Congress in a manner which has little or nothing to do with which party we belong to or whether we consider ourselves to be conservative or liberal. Rather, we are likely to view this issue from a regional perspective, one that is based in great part, on economic considerations. Consequently, it is not possible to develop a control strategy which will appeal to all the competing regional interests. Nevertheless, the members of this committee must continue to work, to formulate a sensible, equitable solution to this problem which threatens our irreplaceable national resources.

I commend you, Mr. Ruckelshaus, for your willingness to assist us in confronting this difficult issue and I look forward to hearing your testimony.

OPENING STATEMENT OF HON. JENNINGS RANDOLPH, U.S. SENATOR FROM THE STATE OF WEST VIRGINIA

Mr. Chairman, I am pleased to join with you and other members of the committee as we again review issues relating to acid rain.

It is appropriate, and we are honored to have with us Bill Ruckelshaus, the Administrator of the Environmental Protection Agency. In the 3 months—to the day—since our last hearing on this subject, there have been several developments that merit our attention. The most significant of these is the administration recommendation for addressing acid rain issues this year.

I observe that today, coincidentally, is Groundhog Day, and I hope that Bill Ruckelshaus will see nothing but sunshine as he shares his thoughts with us.

As we begin the second session of the 98th Congress, acid rain continues to be a divisive and much debated subject. There remains a lack of broad consensus among the scientific community over the causes and cures of acid rain. Many individuals, organizations, and government bodies are concerned about the costs of some of the control programs that have been proposed.

Some of us believe that we should accelerate our efforts to resolve as many as possible of the uncertainties surrounding acid rain. I and others have introduced legislation to commit more resources to acid rain research. It is encouraging, therefore, that President Reagan has asked for an increase in acid rain research funds. It is disturbing, however, that his proposed level of funding is considerably less than that we are told was recommended by the cabinet counsel. I hope that Mr. Ruckelshaus will comment on this situation.

Mr. Chairman, as we begin this series of hearings, I hope the committee will indulge me to restate briefly some of my guiding thoughts as we debate this issue.

It seems that there is general acceptance that acid rain is a problem, even though the degree of seriousness may vary from place to place. In West Virginia we are concerned about the effect of acid rain in our State. There is substantial evidence it has decreased the ability of fish to live in some of our streams and a possibility of forest damage.

At the same time we are concerned that a control program might be instituted that could do irreparable damage to our coal industry and the many thousands of people who depend on it for their livelihood. The recession has left over 40,000 of our miners without jobs. This concern is heightened by a report that West Virginia has now slipped to third place among the States in the production of coal. Wyoming has supplanted us as the second largest producer. I congratulate Senator Simpson on his State's progress in mining and know that he will appreciate the problems of achieving and maintaining high production levels. Any acid rain program that encouraged fuel switching in its early stages or failed to provide for regular review and adjustment could cause further unemployment and permanent disruption in coal markets. I continue to believe that this is not a necessary result of a realistic sulphur reduction effort.

I am encouraged that the range of control proposals has broadened. This makes it possible that a more equitable solution to the problem may be found. This will not happen, however, until acid rain is recognized as a national problem requiring a national solution. No single State or small group of States must be asked to bear this financial and social burden.

Mr. Chairman, throughout my congressional life I have been known as an optimist. Even on this most difficult of issues, I continue to believe that a fair and equitable means of reducing acid rain can be found. It can be done if we put our heads together, recognize the full range of problems, agree to transcend regional concerns, and then attempt to accommodate them fairly and equitably.

We have scheduled in the next 4 days a large number of witnesses representing every possible viewpoint and interest. I hope that they will provide us with information and suggestions that will help the committee carry out its responsibilities.

OPENING STATEMENT OF HON. STEVE SYMMS, U.S. SENATOR FROM THE STATE OF IDAHO

Mr. Ruckelshaus, you and the administration you represent have been and undoubtedly will continue to be subjected to considerable criticism for your failure to propose massive, widespread reductions in emissions of sulfur dioxide.

I think that I know how you feel, because I cast the lone dissenting vote against the committee's acid rain plan 18 months ago.

I also know that the fact that you do not come here to propose a sweeping control plan is not due to an absence of political will, or to a lack of concern about the problem, or because of pressure from the coal or utility lobbies. It is because of the intractable nature of the acid rain problem, whether it is looked at from a scientific, or an economic, or a political point of view.

Like Senator Durenberger, I hate to quote myself, but since he set the precedent, let me quote part of my separate views to the committee bill of last year:

"The argument has been made that we should act now and fill in the gaps in scientific knowledge later. This argument might have merit if we were facing a sudden crisis or if the economic consequences of the committee proposal were not so large. The problem that is loosely identified as 'acid rain' has developed gradually and there is no indication that it will take a sudden turn for the worse in the near future. The massive abatement measures which are proposed would also take years to implement. I think that it is prudent to insist that before committing ourselves to such an undertaking we be reasonably sure that it will in fact solve the problem, and that the environmental benefits are at least commensurate with the costs. By now we should have learned that good intentions and a willingness to spend other people's money are no substitute for a thorough, realistic understanding of the problem."

I think that what I said then is still true, and I salute you for not being stampeded into proposing an emissions reduction program purely for short-term political gain.

Senator STAFFORD. Mr. Ruckelshaus, we will be very happy to hear from you.

STATEMENT OF WILLIAM D. RUCKELSHAUS, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Mr. RUCKELSHAUS. Thank you, Mr. Chairman.

Mr. Chairman, and members of the committee, I can't tell you how much I have been looking forward to appearing before you this morning.

Next to my press conference tomorrow on ethylene dibromide, this is one of my favorite public events. The subject this morning is acid rain. And I suspect that as many of you have suggested in your opening statements, members of this committee have spent more time studying the issue of acid rain than any other before you in the last decade. In the last 9 months I have personally met with over 100 groups and individuals representing every conceivable point of view on the same subject. I have spent countless hours reviewing all aspects of the problem, ranging from the science, to the available control strategies, to who would pay for reductions of the suspect pollutants, to how you would administer a control program. Out of all of this effort one might expect--I am certain many do expect as you have indicated in your opening statements—that I could now lay before this committee a comprehensive solution to which all could repair. Unfortunately, not yet, but I believe we are making progress.

As the President said in his state of the Union speech last week, there is great concern in this country and in Canada about the problem of acid rain. I share that concern as does the President. I am determined to forge an understanding of the causes, effects, and solutions to acid rain as quickly as possible. Several members of this committee already believe we know enough about the problem to fashion a solution. This belief is shared by many in the country. Others in and out of the Congress believe otherwise.

On the basis of the current state of scientific knowledge, the administration is not prepared to recommend additional sulfur oxide controls.

That does not mean the door is closed. It simply means that before launching the country on an expensive and potentially divisive control program, we feel we need more scientific information.

Such questions as the scope and pace of the damage are at the top of the list of our research agenda. In addition, a better understanding of the mechanism whereby deposition affects sensitive areas and of the acidification process itself would be helpful in finalizing any control strategy. We do not believe that pursuing these scientific puzzles as diligently as possible will cause an unacceptable delay. The administration is in favor of finding a solution to the complex problem of acid rain. When the fundamental scientific uncertainties have been reduced, this administration will craft and support an appropriate set of measures to solve the acid rain problem.

Make no mistakes about it, acid rain is a problem. There are some things we know about it and some we don't. I will try to spell out for this committee as clearly and as carefully as possible the nature of the problem as we now understand it and what we are doing to enhance that understanding under the mandate from Congress expressed in title VII of the Energy Security Act in which the Acid Deposition Assessment Program was established.

Since returning to EPA, I have made a special effort to assure that the Agency's review and assessment of scientific facts related to our work is separated from a discussion of what should be done in response to these facts. We have characterized this change as separating risk assessment from risk management. Only in this way can the public be sure that EPA's statement of the science is the most objective and unbiased possible.

Separating out risk assessment from risk management is as vital in the area of acid deposition as it is in other fields of our work. This is the way we have pursued the intensive inquiry into the acid deposition problem. I will start this morning with our assessment of the problem.

This committee has heard extensive testimony on the science of acid rain. I will not try to be exhaustive in discussing what we know or don't know, but will touch only on the points most relevant to the policy deliberations.

STATE OF THE KNOWLEDGE ON ACID RAIN

Again, this is not an exhaustive statement of what our knowledge is. We don't have time to do that this morning. I am going to try to hit the highlights that I think are relevant to the policy considerations. Based on my study of this problem over the last few months, I would summarize what we know about acid rain at this time by the following major points:

The Northeastern United States and Southeastern Canada receive rainfall that is, on average, more acidic than rainfall elsewhere in the country. Rainfall in much of the Northeast has a pH of 4.2 compared with rainfall with a pH of approximately 5.0 to 5.6 elsewhere.

This same region is located downwind from the area in the United States and Canada which has the greatest density of sulfur oxide emissions.

There are acidified, clear lakes—otherwise unaffected by man's activities—in areas which receive heavy acid deposition. In contrast, there are few, if any, affected lakes where acid deposition is less. Most other lakes are unaffected by man's activities.

Most scientists active in the field believe that acid deposition has been a major contributor to acidification of these lakes.

Not all areas in the Eastern United States are sensitive to acid deposition. The areas at risk are those which both receive high levels of acidic deposition and have limited alkalinity or buffering capacity.

We are seeing damage to some tree species in parts of the United States. Several environmental stresses, including acid rain, ozone, trace metals, and drought, may be interacting or acting alone to cause these effects.

GAPS IN OUR INFORMATION

As helpful as these points are, they do not, of course, give a full picture of acid deposition. Our knowledge is incomplete. Congress recognized this in December 1980, when it passed title VII of the

Energy Security Act, authorizing a 10-year research program on acid deposition. The national acid precipitation assessment program [NAPAP] is now under way. We have had the benefit of approximately 2 years of research under that program.

I wish, as I am sure you do, that those 2 years could have eliminated any fundamental gaps in our knowledge of the causes and effects of acid rain. We are making progress, and we are benefitting from this research mandate. We must recognize, however, that for a program of this magnitude and complexity, the research effort is still at a very early stage.

Let me highlight a few of the areas where the unsettled state of knowledge appears to be particularly important to the development of policy.

We really do not know the extent of damage to our aquatic resources from acid deposition. Based on the data available, we know of approximately 200 lakes, almost all of which are in the Adirondacks, that are acidified nationwide. This covers a very small percentage of the surface water of the country. I have no doubt that others will be identified as acidic. But we have not yet made a systematic search for them. Certainly our water quality models would suggest that such additional surface waters susceptible to damage by acid deposition do exist. We need to get a more accurate picture of the scope and extent of this damage.

I am going to touch later in my statement on what we are doing in response to these gaps, Mr. Chairman, because these are the ones that I think are crucial for us to get answers to.

TRENDS

Our knowledge of the pace at which the environment is changing is very thin.

There are four components of the environment where trends are particularly important: First, the sulfate and nitrate concentrations in deposition, second, the pH of rainfall, third, the sulfate and nitrate concentration in water bodies, and fourth, the rate at which water bodies are becoming acidified.

In the area of deposition trends, efforts to monitor trends began in earnest in the United States during the late 1970's. Today, the National Trends Network includes 120 monitoring sites in 48 States, including most of the early monitoring sites established in the 1970's. Several more years of data are needed before any conclusions can be reached from this network about trends in the sulfate and nitrate concentration in precipitation.

Longer time trend analysis has been made on the basis of results from the Hubbard Brook ecosystem study, which ran from 1963 to 1977. The Hubbard Brook data indicate a decrease in sulfate concentrations and an increase in nitrate concentrations in rainfall, but the data did not indicate any trend in pH in the rainfall during the same period.

These limited deposition data suggest that sulfate and nitrate concentrations in deposition reflect changes in emissions and that the net result of decreasing SO_2 emissions and increasing NO_x emissions has been a relatively stable average pH of precipitation.

Turning to the sulfate and nitrate concentration in water bodies, the USGS recently published its study of water-quality records collected over a 10- to 15-year period from the Hydrologic bench-mark network, a nationwide network of sampling stations in predominantely undeveloped stream basins. The data indicate declines in stream sulfate in the Southeast and the West. The USGS concluded that the geographic trends in sulfate concentrations at bench-mark stations approximately coincide with trends in emissions of SO_2 during the period from 1965 to 1980. In contrast, the trends in pH did not follow any pattern. Among the explanations for the lack of a pH trend are the possible effects of nitrate deposition on pH and the neutralizing capacity of many basins which resist changes in pH.

Our knowledge of the trends in the number of water bodies becoming acidic is even thinner. Recent data show a number of lakes having low pH and high sulfate concentrations. Most scientists believe that condition to be the result of acid deposition. We have other data which identify a number of acidified lakes in areas of high acid deposition. These data show a number of other lakes with low alkalinity measurements. But we do not have any long-term data to indicate how the present chemistry of these lakes was established, or over what time period.

Obviously whether we are dealing with a rapidly deteriorating situation or a decades-long phenomenon is important in deciding what to do.

SOURCE RECEPTOR RELATIONSHIPS

No discussion of acid rain would be complete without a discussion of the relation between the sources of emissions and the sensitive receiving areas. Our present knowledge is based, as you know, on very simplified transport/transformation models. The recent National Academy of Sciences panel dealt with this issue at length. Everyone, including the Academy, agrees that further research in this area is important, regardless of whether we have a control strategy or not.

It is fair to say that current models and data analysis cannot accurately predict the impact of a particular group of emission sources on particular receiving areas, several hundred miles away. The assumptions upon which these models are based tend to produce results which indicate that local sources are more important than distant sources of the same size. The relative importance of local versus distant sources as well as many other factors have to be addressed in order to adequately predict source/receptor relationships.

THE ROLE OF DRY DEPOSITION

Related to the transport/transformation issue is the quantitative and qualitative relationship between wet and dry deposition. To date most of our data relate to wet deposition. We do not know the extent of dry deposition that is occurring because reliable field monitoring techniques are not yet available. From the data available, we estimate that the amounts of dry deposition occurring may be from one-half to seven times the level of wet deposition, depending upon the particular location.

In remote areas, estimates are that the dry deposition contribution ranges from equal to half that of the wet deposition. We should learn more about all forms of deposition, particularly dry deposition, if we are to control the precursors to acid rain effectively and efficiently.

THE ACIDIFICATION PROCESS

Over the last year and a half, as the result of new knowledge from our present acid-rain-research program, an issue has been emerging from the scientific and academic communities; it involves two different hypotheses about how the acidification process actually takes place in watersheds and at what pace. For the purpose of this discussion I'll call them the delayed response hypothesis and the direct response hypothesis.

The delayed response hypothesis holds that the acidification of lakes is a long-term process. The accumulation of acid deposition over many years eventually depletes the available acid-neutralizing capacity in the surrounding watershed. As that point is reached, more and more acidity will flow unneutralized into the water body, leading to rapid acidification.

The implication of this hypothesis is that unless acidic deposition is decreased, we will see more and more lakes and streams becoming acidic as the neutralizing capacity is depleted in individual watersheds.

The direct response hypothesis is suggested as especially applicable to the Northeast. It holds that acidification of lakes is more immediate than long term in nature. Under this hypothesis, the sensitivity of a watershed depends upon the rate at which it can neutralize acidity, not upon some limited neutralizing alkalinity capacity. Equilibrium between the rate of acid input and output is established fairly rapidly as precipitation passes through the receiving soils.

This hypothesis implies that the acidification which has already occurred in our lakes and streams is all that will occur unless future levels of acidic deposition increase. I am told by our scientists that there is not enough empirical evidence today to substantiate either of these hypotheses. There are obvious policy implications if the latter hypothesis is true.

EFFECTS ON FORESTS

The final area where additional research is especially important is that of effects on forests. Beyond knowing that there has been an apparent decline in the conditions of some of our forests, we know little about the scope of the problem or its causes. Acid deposition may be a primary cause, and then again it may not. We need to examine not only the direct impact of the deposition on the foliage but also the indirect impact of deposition through changes in chemistry of the soils.

FEDERAL ACTIONS TO DATE

What have we done about this to date? The Federal Government has been addressing the problem of acid rain since the early 1970's, but not in any concerted way until 1981. Any impact we have had on acid rain precursors—sulfur dioxide and nitrogen oxides—is an indirect result of our efforts to control these pollutants for health or other effects under the Clean Air Act.

Nevertheless a significant reduction of sulfur dioxide [SO_2] has occurred. SO_2 emissions peaked in the 1970's and have been dropping since. In the 31-State area often targeted as the area of most concern for purposes of the Eastern part of the country, that drop has been from 25 million tons in the middle 1970's to approximately 22 million tons in 1980. Our analysis shows that absent these efforts, the efforts of the Clean Air Act, sulfur oxide emissions nationwide would have been 50-percent greater in 1980 than they actually were—some 40 million tons versus 27 million. Those same figures for the 31-State region which I mentioned are that absent the Clean Air Act and what we have been doing about sulfur oxides, we would be having 36 million tons of emissions in 1980 versus 22 million tons measured then.

This reduction is even more significant since electrical generation, the source of most of the sulfur oxide emissions, increased 50 percent between 1970 and 1980.

The recent USGS data on the decreased sulfate loadings in northeastern streams gives me hope that this reduction of sulfur oxide emissions is, in fact, working to reduce sulfate deposition on our sensitive resources.

Until 1981, research on the subject of acid rain had been an unfocused set of projects spread among the many executive departments and agencies. Congress call for a national research program has changed all that. We now have an interagency research program administered by a task force chaired jointly by EPA, the Department of Agriculture, and the National Oceanic and Atmospheric Administration [NOAA]. Other agencies, including the Department of Energy and Interior, are active participants.

Because this interagency research program is so vital to the decisionmaking process in the area of acid rain, I wanted to be certain that the research effort was organized and managed as well as possible.

Accordingly, soon after returning to EPA last spring, I convened, along with the Secretary of Agriculture and the Administrator of NOAA, an ad hoc panel under the auspices of EPA's Science Advisory Board to review the whole Federal acid rain research effort—to assess its adequacy, review its scope and management, judge its relevance to policymaking, and recommend possible improvements. The panel's chairman was John Deutch, Dean of Science at the Massachusetts Institute of Technology. I have already provided this committee with a copy of the panel's report. We are now in the process of implementing their recommendations. In fact, the administration's acid-rain budget for fiscal year 1985—which is double the budget this year—is a direct result of those recommendations.

Another important effort under way at EPA for some time, of which I believe you are aware, is the development of the critical assessment document review papers on the acidic deposition phenomenon and its effects. Trying to make a wise decision, when we are confronted with stacks and stacks of individual scientific studies, is difficult to say the least. Each one may be a sound piece of work, but they are often not integrated with one another. At the request of our Science Advisory Board, we have been working with a group of over 50 scientists to produce a scientific, peer-reviewed compilation of these studies. It will be a document all of us can use to determine the current state of the science in the many disciplines relevant to acid rain.

This report, including summaries of each of its major chapters, has undergone extensive peer review and will be published in final form this spring. Here are the draft reports, Mr. Chairman, which we will publish. There are two volumes. We are in the process of preparing an executive summary to summarize exactly what is in those reports. It is the most comprehensive effort to date to try to pull together everything we know on every segment of the science. We asked them to do this without any regard to the policy implications involved. We said we are not interested in what we ought to do about it. We want to know what the problem is. This effort is unique, I think, in that it provides, as I say, the most definitive integration to date on the full range of issues critical to acid rain, including: Precursor emissions; pollutant transfor- mation to acidic compounds; pollutant transport; pollutant deposition; and the effects—both measured and potential—of acidic deposition. This work by the scientific community, led by the interagency task force, has assisted my effort to assess the state of the science over the last several months.

FUTURE ACTIONS

The budgetary history of the national acid precipitation assessment program is impressive, it is listed in my testimony. (See p. 20.) It has moved from $11.5 million in fiscal year 1980 up to $55 million in the President's request next year. This year we will be spending some $27.6 million. We will be asking for a supplemental from the Congress for $5.5 million for a lake survey, which I will describe in a minute.

This money is aimed at increasing our knowledge of the causes and effects of acid rain. I have attached a summary of this research effort. (See p. 21.)

Important to a cost-effective control strategy will be success in developing new technology. The administration's budget includes $67 million for this purpose in fiscal year 1985.

The President has also committed $5 million for an experimental program to help restore the buffering capacity that has been reduced in affected lakes over the years. This program, to be administered by the Fish and Wildlife Service, will be closely tied to our overall research effort and will build upon existing experience. A number of countries in Scandinavia have had some experience in employing lake restoration techniques.

The States will be involved in the design and implementation of this program. It will involve restoration of a number of lakes. We will seek to protect certain sensitive lakes from further deterioration and help others recover from dangerously low pH levels. While we do not view restoration as a permanent or long-term solution to the acid rain problem, it may prove to be an essential component to addressing acid rain now as well as in the future.

With the $55.5 million for the interagency research effort, $5 million for effects mitigation, and $67 million for control-technology research, the President is requesting a total of $127.5 million in fiscal year 1985 for efforts to address acid rain.

NEW RESEARCH INITIATIVES

Now I would like to focus on how we have been using our research resources to fill some of the key information gaps I have already identified.

SCOPE

To improve our knowledge of the effect that acid rain has had on the Nation's aquatic resources, I directed the EPA staff last November to immediately begin the design and implementation of a national lake survey to measure the water quality of some 2,000 to 3,000 lakes located in areas of the Nation we believe are potentially sensitive to acid deposition. This includes lakes in all of the sensitive regions of the United States. Pilot sampling has already been carried out in New England and New York to test out field procedures. This research effort was summarized for me yesterday. We have looked at some 59 lakes in the last 3 weeks in Vermont, Maine, New Hampshire, and New York, to test out the sampling procedures. They are using helicopters. Needless to say, the weather is difficult at this time of year in those areas but the sampling techniques have been proven out and we think that in the summer, when this survey will be in full operation because the lakes are more stabilized at that time, we will have a much firmer data base on the basis of which to do a number of things, not the least of which is to understand what the trends are.

These water quality measurements are scheduled as I said to be completed by the end of 1984 and will be the first phase of a planned three-phase program. The second phase will extend the survey to the chemistry of streams in these areas and will also include a biological survey of a subset of the lakes in the initial survey. The final phase will be the long-term monitoring of a representative number of lakes and streams to record trends in the chemistry and biota of these waters as well as acid deposition.

This study is designed to answer these important questions: One, how many surface waters today show evidence of acidification? Two, what influence does acid rain have on surface water chemistry and biota? Three, what percent of these sensitive surface waters now support fish? And four, what impact do changes in acid deposition levels have, over time, on lake acidity?

Our planned research program includes several major elements designed to fill the gaps in trend data which I outlined earlier:

SULFATE AND NITRATE CONCENTRATIONS IN DEPOSITION

In fiscal year 1985, the wet deposition monitoring efforts will expand the number of wet deposition monitoring sites under the national trends network. The original network was to have had approximately 150 sites established by the end of 1985. As I mentioned, we have about 140 now. With the additional research funding, the network will be expanded by 40 to 50 additional sites within the same time period. The expanded number of stations will provide the deposition data required at the long-term lake and ecological monitoring sites.

Up to this time we have had no measured data on dry deposition. The research program calls for the establishment of a number of pilot dry deposition monitoring sites. These sites will be part of an accelerated effort to develop and validate dry deposition monitoring techniques, and they will provide the first data on dry deposition in 1985.

PH OF RAINFALL

This same expansion of the national trends network will give us much better information on the trends in pH of rainfall across the country.

SULFATE AND NITRATE CONCENTRATION IN RECEPTORS, INCLUDING WATER BODIES

Current plans call for the establishment of 40 to 50 long-term environmental effects monitoring sites. These will include lake survey phase III sites and a number of additional sites where we will monitor for terrestrial, soil, and surface water effects. They will be coordinated with the additional national trends network wet deposition monitoring sites. These data will provide extensive information at the process level on trends in chemistry and effects. These sites will be established in 1985 and will be designed to provide an early warning of any dramatic environmental changes that might occur.

NUMBER OF WATER BODIES BECOMING ACIDIFIED

The national lake survey to be carried out this year will provide us a baseline of water bodies now acidified. It will also provide us with the information to select long-term monitoring sites, which will be representative of watersheds nationwide for the purpose of discerning trends in lake acidification.

SOURCE/RECEPTOR RELATIONSHIPS

To attempt to help resolve important questions regarding sources and receptors, we plan to conduct field studies to try to relate pollutant sources to acidic deposition. Studies now underway should help us understand the processes that govern the formation of acidic pollutants in the atmosphere, and their transport and deposition in sensitive areas.

We are also planning a large-scale atmospheric investigation to obtain empirical data on source/receptor relationships. As part of this research, a major experiment has just been completed in which inert tracers were released in the Midwest and Canada and then tracked in air masses moving across the Northeastern United States and Southeastern Canada. Initial findings will be available later this year.

THE ACIDIFICATION PROCESS

We are asking the National Academy of Sciences to convene a scientific meeting as soon as possible to review the two hypotheses regarding aquatic acidification—the delayed response and direct response hypotheses—and determine whether they are legitimately in dispute, and, if so, to recommend additional research initiatives to help resolve the areas of disagreement. We currently have research going on, Mr. Chairman, to try to get at the question of which of these two hypotheses is in fact most directly applicable to the Northeast and other sensitive areas.

EFFECTS ON FORESTS

In order to learn more about possible terrestrial effects, we are planning extensive long-term studies to determine whether acid rain has caused damage or changes in rate of growth and species composition in forests. Detailed planning for the forest survey began in 1983. The forest survey is being designed now, and it should be available for implementation in about a year.

The fiscal year 1985 research program includes a large expansion of the effort on terrestrial effects. In addition to the forest survey which I just described, the program calls for extensive new research to examine problems of nutrient leaching, metal mobilization, soil chemistry, and the physiology and pathology of trees.

Obviously this testimony cannot include all the research in which we are engaged, but I have sought to highlight how we are attempting to fill some gaps in our knowledge important to the development of policy.

In conclusion let me make two points. First, I am sure—and any lack of assurance I had was erased at the beginning of this hearing—that you join me in feeling a certain frustration when it comes to the timeliness of scientific research results. I know I want, and I am sure you want, information right when we need it on which we can base sound policy judgments. But often the information we want and need is not there. Had we started all of this research 10 years ago we might have avoided much of the uncertainty and inevitable emotion which now complicates our successful development of policy on this issue.

It is not the fault of the scientists. Key scientific questions—which in the case of acid rain include effects on forests, water, and soils—require substantial periods of time to investigate and answer. Often, historical data are found to be sketchy and incomplete. The physical and chemical phenomena which the scientists deal with in studying the causes and effects of acid rain are extraordinarily complex.

In acid rain research, it is going to be difficult to reduce the time the scientists need to accumulate information, sort it out, make supportable scientific judgments, and draw final conclusions. I pledge to this committee my best efforts to accelerate the time when we can get needed answers.

Finally, we must understand that delaying a control strategy decision to gain better information involves the question of whether we are dealing with an emergency or a phenomenon that can be addressed over a longer period of time.

Obviously if we have more time to reduce precursor emissions, it can be done with less expense and social disruption to the country.

Our research effort and our caution in recommending a control strategy are aimed at both the questions of trends and expense. If we find the trends are gradual or, under the direct response theory, stable with regard to the lakes, that will suggest one course of action. If, not, then we may need to act faster and with less knowledge of causes and effects and of the advanced technology necessary to hold down the expense and disruption of a large control program.

We are working hard to understand the trends. With a nationwide monitoring system in place, we will no longer be in the dark as to what is happening and how fast.

In the meantime, EPA is working with the States through STAPPA and ALAPCO to design a model control program to insure we are ready should the facts warrant action.

Mr. Chairman, I recognize this issue has been a most divisive one between this committee and the administration. As in other areas affecting this committee and EPA, I will do everything I can to help smooth the way toward the development of sound public policy.

This issue has the potential for dividing the country along regional lines and creating much rancor and little progress.

I believe if we all approach it with good will and a recognition of the legitimate concerns of people in every section of the country and of our neighbors to the north, we can solve it.

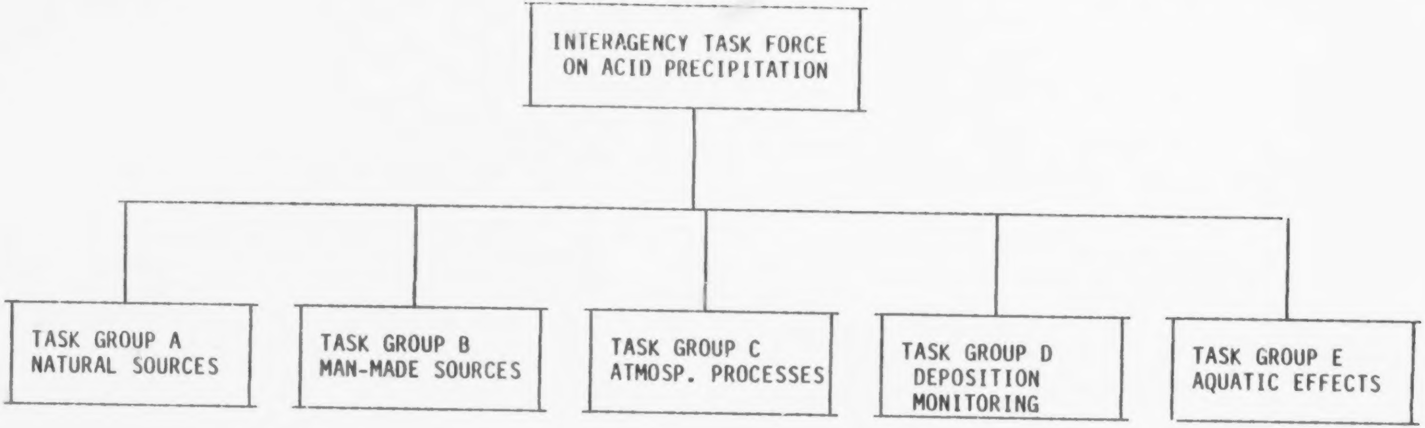
It is in that spirit that I offer this testimony and pledge my best efforts to resolve our differences.

[Attachments to Mr. Ruckelshaus' statement follow:]

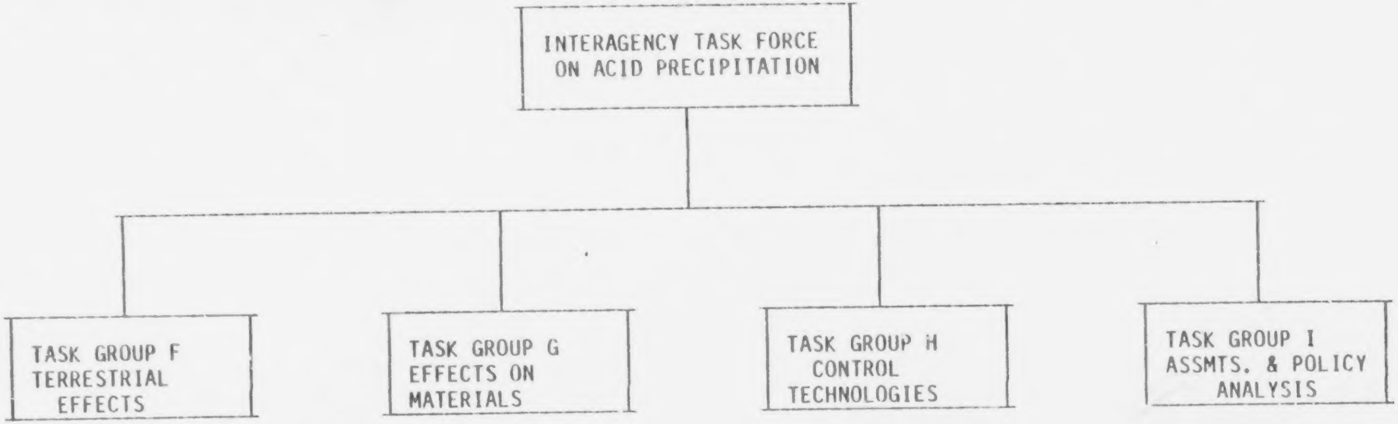
Future Actions

The budgetary history of the National Acid Precipitation Assessment Program is impressive:

Fiscal Year	$ million
1980	$11.5
1981	$13.0
1982	$18.2
1983	$22.6
1984	$27.6
1984 Supplemental Request	$5.5
1985 Request	$55.5
TOTAL:	$153.9



TASK GROUP A NATURAL SOURCES	TASK GROUP B MAN-MADE SOURCES	TASK GROUP C ATMOSP. PROCESSES	TASK GROUP D DEPOSITION MONITORING	TASK GROUP E AQUATIC EFFECTS
o Biogenic sulfur emission inventory, land and oceans	o 1980 & 1984 inventories of man-made emissions	o Evaluation of currently available acid dep. models	o National Trends Network for wet deposition	o Survey of sensitive lakes and streams
o Natural nitrogen oxide emissions inventory	o Historical emission inventories for trends analysis	o Development of a new non-linear "benchmark" model for acid deposition	o Participation in Global Trends Network for wet deposition	o Maps of alkalinity
o Alkaline materials inventory from land and oceans	o Emission sector models for utility & industrial sectors for emission/control strategy forecasting	o Field experiments with tracers to study transport	o Research on new approaches for dry deposition monitoring	o Models for predicting chemical & biological response to acid dep
		o Field experiments in clouds & fogs to study transformation & scavenging	o Annual reports on deposition data & trends	o Effects of acid deposition on drinking water supplies
				o Guidance on methods of liming/restocking and post-liming monitoring


INTERAGENCY TASK FORCE ON ACID PRECIPITATION
TASK GROUP F TERRESTRIAL EFFECTS
TASK GROUP G EFFECTS ON MATERIALS
TASK GROUP H CONTROL TECHNOLOGIES
TASK GROUP I ASSMTS. & POLICY ANALYSIS

TASK GROUP F TERRESTRIAL EFFECTS

- Dose-response models for corn and soybeans
- Importance of aluminum mobilization in soils
- Cation nutrient loss from forests
- Effects of acid dep on forest productivity
- Watershed studies of the effects of acid deposition on terrestrial & aquatic ecosystems

TASK GROUP G EFFECTS ON MATERIALS

- Inventory of common materials & cultural resources at risk
- Dose-response for materials from field and chamber exposures
- Life-cycle costs for common materials
- Protection & mitigation measures for damaged materials & cultural objects

TASK GROUP H CONTROL TECHNOLOGIES

- Inventory of current coal cleaning practices
- Inventory of potential users for SO_2 or NO_x technologies including retrofit difficulty
- Assessments of existing and new control technologies

TASK GROUP I ASSMTS. & POLICY ANALYSIS

- Assessment of current and potential damages in physical & economic terms
- Cost-benefit methodology for analysis of control strategies for acid depostion
- Analysis of significance of new scientific results
- Uncertainty analysis of damage estimates and cost-benefit analysis for research planning and policy use

Senator STAFFORD. Thank you very much, Mr. Administrator. If my colleagues are agreeable I will suggest that we allocate to each of us 10 minutes for the first round of questions and then have additional rounds after everybody has completed their questions. Is that agreeable? If so we will do it that way.

The Chair would reserve to members who are not here at the opening and who wish an opportunity to make an opening statement to have it placed with the other opening statements at the beginning of the meeting.

Mr. Ruckelshaus, I think you are going to be asked this question anyway. So I might as well start with it. If you can, would you describe for the committee the nature of the acid rain control programs which you have presented to the Cabinet Council and also describe the meeting at which it was discussed and who might have attended that meeting and were critical of your proposals?

I say if you can.

Mr. RUCKELSHAUS. There is no question I am going to be asked that question not only by you but by others. I have already been asked it in the opening statements. Let me tell you how I view my response to that and make my position as clear as I can.

I think my responsibility, as part of an administration where we have an issue that is of such importance that it needs to be addressed by the President, is to provide for him what I believe are an array of options that are all within the band of responsible answers to that issue, to provide for him all of the pros and cons of any particular option that he might choose, and then do the best I can to make a sound recommendation.

I think that in the process of doing that I have got to protect the President's decisionmaking ability so that he can choose whichever option he deems is the correct one as far as the public interest is concerned. That is what I have done in this case. I have presented it to the Cabinet, to the Cabinet Council, and to the President in the form of this array of options. I have made a recommendation. I think that the President's choice of an option is a rational one. I don't think it is irresponsible. I think there is a band of options that could be chosen that are not irresponsible, including some that have been chosen by members of this committee, and some that have been chosen by other Members of Congress. But I believe that having done that, and the President, as the only official elected by all the people of this country having made that choice, it is then my responsibility as Administrator of this Agency—assuming I think that choice is a responsible one, which I do—to do the best I can to defend it.

In the case of this committee, as I have suggested, I think it is also my obligation as a public servant to try to work through the obvious differences that exist between the members of this committee and the administration to see if some longer term solution can't be fashioned.

Senator STAFFORD. Thank you very much, sir.

Let me ask you one additional question. If you have studied, I presume you have, the acid rain control bill approved by this committee in July 1982 by a vote of 15 to 1, you will know that we mandated a reduction in sulfur dioxide emissions of 8 million tons per annum. You will also know that no irrevocable action must be taken until 1993, 9 years from now. I am not particularly fond of that provision but it was insisted upon by some members who believe that there should be a midcourse correction, to use Ed Muskie's favorite term, if research began indicating that a control program was unwarranted or should be changed.

I would ask you how can this administration oppose a control program which does not require significant reduction until 1993 more than 2 years after all of the studies on acid rain mandated by the Congress will be completed?

Mr. **Ruckelshaus**. Mr. Chairman, there is no question in anybody's mind—and it is reflected not only in your bill but in others pending before Congress—that in order to get a control program up and in place and actually start getting reductions in SO_2 emissions or NO_x emissions, it is going to take a period of time, whether it is 4, 5, 6 years, however long it is. One of the things we have been trying to do as I mentioned in my testimony, is shorten the period of time in which we could respond—assuming the Congress, with the administration's support or without, endorses a control program—by working hard with our State counterparts to develop a model control program.

One of the inhibiting factors about achieving an SO_2 reduction is the administrative problems involved. Those aren't the kinds of problems that have received any attention in testimony or in the public debate, but they are severe. And getting the kinds of reductions we are talking about or the Congress is talking about in the States involved takes a good deal of effort on the part of EPA and the States.

One of the things we are trying to do to shorten that period of time, should a control strategy be adopted by the Congress, is to get that problem out of the way, get that mechanism in place. You questioned how the administration could suggest that they wouldn't support a bill that doesn't take effect until 1993. The administration position isn't a lot different than that. The question is whether we ought to decide now that that is where we are going and then try to correct the course in midstream or whether we should recognize or we should assume that we need to wait a little while longer before deciding whether we need a control program or exactly what it ought to look like.

I think some of the experiences we have had with midcourse corrections in some of the laws that we are administering in this country hasn't been all that favorable. We have set up commissions, under the Clean Air Act, Clean Water Act, to try to provide for midcourse corrections. Often that just increases the emotionalism of debate, increases the complexity of attempting to get midcourse corrections, and that frankly is one of the things that is of concern to the administration.

Senator **Stafford**. Thank you very much.

Senator Chafee.

Senator **Chafee** [presiding]. Mr. Ruckelshaus, in your testimony you indicated that as far as the dry deposition monitoring sites in the forest survey implementation, both of those are going to start collecting data in early 1985, it seems to me that this can go on forever.

When do we reach the end of this gathering of data and come to some conclusions?

Mr. RUCKELSHAUS. Let me answer your question in two parts, Senator. One, I would hope we never stop collecting data because wherever we are in this whole exercise, I am absolutely convinced that 5 years from now we will have come to some opposite conclusions from what we have today. We may decide the problem is worse than we thought it was today. We may decide it is different in a number of its aspects. But I think we need to continue this research regardless of what we do. And the problem is, as I mentioned, and it is the same frustration I have in discussing this with the scientists, that these scientific studies take a frustratingly long time.

They have been in the process of designing the forest study now since 1983. It is a complicated enough study that before putting it in place they want to make sure that they know enough about the methodology that they are going to use to make it a sound study. It is a study that they can rely on when the results start coming in. By the same token, with dry deposition, I have viewed our own dry deposition measuring instruments at Research Triangle Park in North Carolina. They are very crude. We don't really know at this point exactly how to measure, how to monitor dry deposition.

What we are doing is trying to get the present instrumentation as much up to speed as possible, as much perfected as possible, and then put it in the field. We simply don't have instrumentation today that we can put in the field that can really measure dry deposition.

How long does this go on before we come to a conclusion?

I guess you can look on the research effort, in terms of where the people are on it and what they are willing to conclude by it, as a continuum, and as each new piece of information comes in, it sometimes pushes the people over the point at which they say we think we now know enough to proceed or not to proceed.

I assume people are looking at this as actively as they can, and within this continuum there are those who have concluded, including most members of this committee, that we now know enough to proceed.

There are others who are short of that. As additional information comes from our research efforts, assuming it will push this whole thing in this direction, if the evidence accumulates that the problems are occurring and we know what to do about solving them, then we will find more and more people, including the administration, moving into that segment of the band which says we now know enough to act.

As to exactly what point in time that will happen, is very difficult to predict.

Senator CHAFEE. I think I reflect the view of this committee, as you indicated earlier, that this gathering of data and information and monitoring can go on and always can continue forever as you, yourself, indicate. It can always be used as an excuse to not take any action. Here the administration itself appoints an acid rain peer review panel after it had the earlier report—this took place in May 1983 and as I mentioned in my statement, that very group said recommendations based upon an imperfect data run the risk of being in error.

Recommendations for inaction pending collection of all of the desirable data entail even greater risk of damage. I just feel that this thing is going on and on and here in your own testimony, you indicated that you are going to start gathering some additional data in which you don't even start for the forest survey implementation in about a year, you say, that gets us to early 1985 where you just are starting to gather your data.

Presumably it is going to take a year or two to study that.

Let me ask you——

Mr. RUCKELSHAUS. Mr. Chairman, I would interject one thing.

What I tried to do at the first part is to say what we now know about forest trends in this country. There is data, additional data that has been gathered for some years in Europe. It is a particularly troublesome problem in Germany. We do have some data on what is happening in the forests. What I am suggesting, what we are doing in response to what we see as the inadequacy of that data, is making sure that we have a better baseline in the future, whenever we decide to go forward.

I am not suggesting that it is only when all of this data is in that a decision would be made to support a controlled program and go forward.

I think this should have been done 10 years ago. If it had been done 10 years ago, we wouldn't be sitting here today with the kinds of disputes that exist not only before this committee but in the country.

Senator CHAFEE. I am not so sure we wouldn't be sitting here today at the rate things are going.

Mr. RUCKELSHAUS. I wouldn't be sitting here today.

Senator CHAFEE. Mr. Administrator, over the last several years, EPA has allowed some midwestern and, indeed, some Northeastern States to relax their clean air implementation plans and I believe as the information I have is that this resulted in an increase about 1.5 to 2 million tons of additional SO_2 in the atmosphere.

Obviously, this adds to our problems. Is the EPA's intention to allow further SIP relaxation?

Mr. RUCKELSHAUS. Mr. Chairman, let me describe what is happening. The State implementation plans give requirements for emissions to individual emitters or to regions based on the necessity of achieving the national ambient air quality standard, the SO_2 standard, either primary or secondary for that region.

If the State implementation plan has in it a requirement that forces those emissions below the allowable limit under the ambient air quality standard, and the State comes in and asks for an amendment to the plan which would increase the allowable emission within what they are permitted to have under the ambient standard, which is the guiding principle here, we have no choice but to approve those amendments, if in fact everything we know both from modeling and actual measuring shows that there would not be a violation of the ambient standard.

Often we will have the existing standard under the State implementation plan exceeded now. If the States then come in for an amendment asking for an allowable increase, we have no choice but to grant it.

The figure that you cite of over 1 million tons since 1981, 1982, and 1983, is the States moving up their allowable limits under the ambient air quality standards of the current law. The actual emissions are far less than that because what they are doing was amending.

Senator **CHAFEE**. Are the States who are allowing the increase, have they achieved the attainment?

Mr. **RUCKELSHAUS**. Everything which was granted has. There have been some we don't grant. We have actions against some States involved, against some where there are nonattainment areas. But there is no attainment problem in the States where the State implementation plan amendments have been granted.

If there were a problem, we wouldn't grant it to them.

Senator **CHAFEE**. My time is up.

Senator Moynihan.

Senator **MOYNIHAN**. Thank you, Mr. Chairman.

Mr. Ruckelshaus, on the subject of research and its frustrations and its ambiguities, we acknowledge that and don't in any way feel that you are offering that fact as the basic source of difficulty.

We began this inquiry a long time ago with research as its principal element. But what worries us are two things:

One, I will be very explicit, the Cabinet Council on Natural Resources and the Environment met in September as we understand to make basic decisions about what would be proposed in this and other matters.

The Washington Post on January 29, 1984, reports that Mr. Stockman presented to that Cabinet Council a document called "The Politics of Acid Rain," in which they simply added up the electoral votes of the polluters and added up the electoral votes of the polluted and decided the former were more important and that is why we end up with—we welcome the increased research moneys—but we wonder what really was the basis of the decision.

Could you help me on that?

Mr. **RUCKELSHAUS**. Senator, if the implication is the decision was based on adding up the electoral votes of the areas that are putting SO_2 in the air and comparing them to the electoral votes of the areas that are receiving the results of those emissions, if the question is was that the basis of the decision, the answer is no.

If you are suggesting that in a decision of this kind are these people who will argue the politics of it, of course the answer is yes. They will.

Senator **MOYNIHAN**. So they might have been a pamphlet called "The Politics of Acid Rain?"

Mr. **RUCKELSHAUS**. If there is such a pamphlet, I haven't seen it.

Senator **MOYNIHAN**. They withhold things?

Mr. **RUCKELSHAUS**. Never. No. I know everything that is going on.

Senator **MOYNIHAN**. Two questions: The point is it was, after all, the peer review panel that Dr. Nierenberg headed saying, as Senator Chafee just remarked, that if we take the conservative view that we must wait until the scientific knowledge is definitive, the accumulated deposition and damaged environment may reach the point of irreversability.

That is something that we here are responsible for. And it is a very large question to us whether we will just take the bet that that isn't so, that the President's peer review said it may very well be so.

Mr. RUCKELSHAUS. Dr. Nierenberg, along with the Chairman of the National Academy of Sciences Panel, two members of the panel, and one member of Dr. Nierenberg's committee, appeared before the President and the entire Cabinet and discussed just the science of the issue in September.

I asked then to come. We spent over an hour. We stayed out of what ought to be done about it. We just discussed what the findings were. I spent a good deal of time with Dr. Nierenberg and also with Dr. Ruth Patrick, who was on the President's committee.

The irreversibility question has to do with the potential effect on soils. Her particular concern is that the effects of acid deposition on the soils may present a much more serious problem in the long run.

Senator MOYNIHAN. Than on waters.

Mr. RUCKELSHAUS. Pardon me?

Senator MOYNIHAN. Than on water?

Mr. RUCKELSHAUS. Yes. That is where the irreversibility question is. Based on the hypothesis you suggest, then the quickest change, obviously, that occurs in any media is when you put something in the air.

The minute you put it in the air it changes.

The second quickest is the lakes; and the third is the soil, because of the complexity of the soil and the difficulty in changing it.

What she is worried about in talking about irreversibility is that while the effects on the soils could be more long range, if those effects were in fact to occur, making the soils come back would be a much longer range proposition as well.

Senator MOYNIHAN. Could I, then, ask you just one last point in this round? You suggest that the two basic models that you are concerned with are on the one hand the delayed response and on the other hand the direct response.

Do I take it that the hypotheses with respect to the direct response basically says that the precision with respect to acidification in New York, in New England, in Canada is a stable one, absent any greater deposition of SO_2 and the like?

There is not going to be any greater deposition, therefore, there is no problem.

Mr. RUCKELSHAUS. That is the scientific proposition. I have been over that at some length with the scientists who espouse that. That is their position.

Senator MOYNIHAN. Could you, in all fairness, let this committee know who those scientists are? I would like to call them up, not to accuse them of anything.

But you know, it is a proposition that you don't have to do anything; right?

Mr. RUCKELSHAUS. Not necessarily.

Senator MOYNIHAN. You don't have to do much of anything?

Mr. **RUCKELSHAUS**. Well, it is a time-related question. You may still decide that prudence would dictate that the levels of SO_2 should start coming down, or nitrogen oxides should start coming down, but the question whether they need to come down like that or come down like that is a much different thing.

Senator **MOYNIHAN**. But it is basically the proposition that the present situation will not significantly change unless there is a change in emissions.

Mr. **RUCKELSHAUS**. That is right. The proposition baldly stated is what you see is what you get, assuming pH levels stay the same.

Senator **MOYNIHAN**. That therefore there is really perhaps no need for legislation of any kind.

Mr. **RUCKELSHAUS**. No. They don't try to conclude that. I mean that is something that you and I might have a discussion about, but that is not what they think are trying to conclude.

I would be happy to give you the names of those scientists. I would much rather have them define their proposition than do so myself before this committee. The cumulative delayed response is the response I think most people—at least the public—believe is what is occurring. It is a much more widespread interpretation of what is happening.

We are trying to convene both of those groups through the National Academy of Sciences to determine if they are as far apart as it appears and if there are methods by which we can accelerate the research to try to prove out those hypotheses.

Senator **MOYNIHAN**. Mr. Chairman, I would suggest this committee might have a panel in which both views are represented and hear them out.

Senator **CHAFEE**. I think that has a lot of merit.

Senator **MITCHELL**. Thank you, Mr. Chairman.

Mr. Ruckelshaus, in your statement you said that rainfall in much of the Northeast has the pH 4.2, compared with rainfall with a pH of approximately 5 to 5.6 elsewhere. That doesn't sound like much to the laymen but it should be pointed out, should it not, that a reduction of one point in the pH level represents an increase of tenfold in the level of the acidity. Isn't that correct?

Mr. **RUCKELSHAUS**. Certainly. I didn't mean to imply that wasn't a problem.

Senator **MITCHELL**. I understand. So a reduction of pH from 5.2 to 4.2 means that the area receiving a 4.2-pH rainfall is getting rain 10 times as acid as the 5.2 area. That's correct, isn't it?

Mr. **RUCKELSHAUS**. It may be even more than that in some areas.

Senator **MITCHELL**. At least 10 times? And if you go from 5.2 to 3.2 there being a logarithmic effect the increase in the level of acidity is 100 times, is it not?

Mr. **RUCKELSHAUS**. Yes.

Senator **MITCHELL**. A further statement in your opening remarks, you commented on the decline in sulfur dioxide emissions that have occurred since the midseventies. You did not deal with current projections and less there be any implication that this is a trend that is expected to continue, I merely want to establish that although there is obviously uncertainty about future emissions it is the projection of your agency that current levels and distributions of sulfur dioxide emissions are expected to remain roughly constant over the next 20 years. Is that correct?

Mr. RUCKELSHAUS. That is right.

Senator MITCHELL. You answered Senator Stafford's question about what your view was, what your recommendation of the Cabinet Council was, by in effect not answering it, saying while you made your recommendation and now you are part of the aministration and you are going to defend it as best you can, you referred to the President's position as rational, not irresponsible, somewhat modest characterization I would say. I think though that we have a right to expect more on that because it was your independent and your personal integrity and your assurance of personal access to the President on this and other issues that dominated your confirmation hearings. You stressed your independence.

We stressed your integrity and how you feel about an issue as opposed to how the President feels about it was an important factor in your confirmation process because you entered office under unique circumstances. Your predecessor resigned under controversial circumstances. There was a lot of controversy within EPA, criticism of the administration. It was perceived as a political liability and who best to appoint but someone whose personal integrity was unquestioned and remains unquestioned and whose independence was stressed.

So I think we are entitled to know whether or not the recommendation made by the President is consistent with the recommendation that you made to him.

Mr. RUCKELSHAUS. Senator, let me indicate to you that I would describe on the spectrum that I talked about in terms of rational policy addressed to these issues, as everybody's position who is in that including your own, as being not irresponsible, not irrational.

Senator MITCHELL. Thank you.

Mr. RUCKELSHAUS. I would mean nothing other than that in terms of where I would fall out, I do not view this issue as one of my own personal integrity in terms of being part of an administration. As to whether I should go out and lobby for my position or suggest what my position is versus the President, if I believe the President is fundamentally wrong in what he is doing in an area, then I always have an option I can pursue. In fact, I pursued that option in the past. But I don't choose to do that in this case because I feel that what the President has done is supportable. It was certainly one of the options that I presented to him and I do not believe that it is a position that I can't support. That is what I am doing here is supporting that.

I don't see it as an issue of my own independence or my own integrity. I am part of this administration. As long as I am part of this administration and we are arguing about what position ought to be taken by the President and he comes out as I recommend or differently then I recommend, then I think my obligation as part of this administration is to support it and that is what I am doing.

Senator MITCHELL. It is obvious we are not going to get any more from you on that.

I do believe that we should be getting more but with the limit on time, I don't want to waste my time on that any further. I would like to now turn to the question of the time when we can expect some action.

In response to Senator Chafee's question you said, well, we can't give an exact time. My answer to that is nobody has asked you for an exact time but you haven't given us any time at all. You have given no indication whatsoever of when we might expect it other than to say in your answer to another question, well, wait a little while longer. Again, in the document presented to you by your own agency's deposition task force, which as you know was published in the Bureau of National Affairs, the question of research was discussed and it indicates that current plans call for research to have a final evaluation by 1989. And then indicates that additional funding could accelerate some of the efforts. You do say in your statement that this administration will craft and support an appropriate set of measures implying at least that this will be done before January 1985 under some circumstances and January 1989 under other circumstances.

I think we are entitled to have some indication. Nobody is asking you for an exact time, a month, a day. But a year, a range of years, a decade. You see, we have been through this over, and over, and over again with your predecessor. And the same answer has been given to us over, and over, and over again. So what can you tell us in terms of time?

Mr. RUCKELSHAUS. You are asking me, Senator, to give you a time, even a range of times, when the administration will conclude that the facts warrant the support of an SO_2 control program?

Senator MITCHELL. Or that the facts lead you to conclude that no control program is appropriate.

Mr. RUCKELSHAUS. I don't know if we are ever going to be able at a later point to say we absolutely never are going to believe an SO_2 program makes sense. I suppose researchers could have some findings and could come to you and say SO_2 has nothing to do with acid rain, and at that point, if everybody agreed, if the scientific community agreed, why, we might arrive at that position. That is a long way from where the scientists certainly are now and I think it is unlikely that this kind of conclusion will be reached.

But you are asking me to suggest when it is we are going to arrive at the conclusion on the spectrum that enough information is present, that we know enough about what the problem is and what ought to be done about it that here is the suggestion we are going to make for proceeding. You are asking me to predict what human beings are going to do and how they are going to arrive at conclusions in the future. The reason for the 1989 date on the research program is that is what the Congress mandated under the National Acid Precipitation Assessment Act, it was a 10-year program. That is the reason that the research was laid out for increments concluding in 1989. Obviously with the congressional interest and public concern about this issue, 10 years isn't acceptable. The public in your part of the country certainly, I am perfectly aware of it, wants action now.

And to the extent that I cannot sit here today and say we are ready to endorse action tomorrow, my position is not going to be acceptable to people in your part of the country. You are asking me when is it we are going to be able to arrive at a conclusion. I wish I could give you a deadline. I wish I could say between July and January or between January and April. Just as sure as I gave you that deadline, some piece of information or something would happen that would make it difficult to do that. This is not an issue that people normally tend to come together around as I think the debate in this country indicates. I suspect there will come a point at which any administration will say we know enough now to move, just as you have decided to do on this committee.

But I find it impossible to say when it is that the administration is going to decide we know enough to move. I think that the commitment to do so will come when the information is adequate to convince the people on that spectrum who are in the administration that we ought to proceed. But if you ask me to guess when, I find it very difficult to answer that question.

Senator MITCHELL. My time is up. I will pursue that in the next round of questions.

Thank you.

Senator CHAFEE. Senator Humphrey.

Senator HUMPHREY. Mr. Chairman, before I direct a few questions to the Administrator I would like to note that an important conference on acid rain was held in my State last month by the Citizens Conference to Stop Acid Rain at which was gathered considerable expertise on this matter and from which resulted, among other things, a platform on the subject of acid rain. With the consent of the chairman, I would like to place that platform in the record. There being no objection.

[The material referred to follows:]

ACID
RAIN
'84

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New England Natural Resources Center

Sierra Club

Society for the Protection of New Hampshire Forests

[illegible] Clean Air Coalition

CITIZENS' PLATFORM

Air pollution and associated acid rain are national problems which are causing extensive damage to our environment. Without immediate action to stop acid rain, this damage will continue with severe consequences to the natural resources, public health and economy of our nation.

Solutions to the acid rain problem must be initiated by the federal government. Congress has tried but failed to pass a law which would stop acid rain. President Reagan has failed to provide leadership in solving the problem.

The citizens of the United States urgently call upon the President and Congress to establish early this year, an Acid Rain Control Program which provides for the following:

1. A commitment to reduce sulfur dioxide emissions nationwide by 50% by 1990 toward reducing wet sulfate deposition to less than 18 lbs/acre/year (20 kilograms/hectare/year) in moderately sensitive areas and 8 lbs/acre/year (9 kilograms/hectare/year) in extremely sensitive areas

2. Significant interim reductions in sulfur dioxide emissions

3. Further reductions in nitrogen oxides emissions by 1990

4. Acid rain control accomplished without extensive economic disruption. Proven and environmentally sound technologies to control acid rain are available now. Control techniques that both preserve existing jobs and create new ones can and should be applied.

5. Measures to protect sensitive but still healthy ecosystems to prevent degradation from increases in acid pollution

6. Establishment with the Canadian Government of a joint United States/Canada Acid Rain Control Program to achieve these objectives

***

**ACID
RAIN
'84**

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

ADDENDUM TO CITIZENS' PLATFORM

Additional comments were developed by the regional caucuses and are hereby included, as an addendum, to the Citizens' Platform:

1. We believe that conservation and renewable enerby technologies should be vigorously pursued as both short-term and long-term solutions to air pollution problems.

2. Acid deposition reductions are to be 50% of 1980 actual annual emissions.

3. Reductions in nitrogen oxides emissions must be addressed in the same level of detail as sulfur emissions. In particular, nitrogen oxides should be added as a substance limited by increments under the PSD program and nitrogen oxides emissions from light and heavy trucks should be limited.

4. Amend the PSD program to link sulfur dioxide and nitrogen oxides emissions with pH changes in watersheds. Drops in pH below the standards set forth in the Clean Water Act should be prohibited.

5. The existing schedule for control of sulfur dioxide emissions from copper smelters in the southwest should be retained and strengthened.

6. The Clean Air Act should be strengthened to insure that one state is prevented from emitting air pollution which could endanger the public health or welfare in another state regardless of violations of ambient air standards.

7. A bilateral agreement must be reached with Mexico to control sulfur dioxide emissions that will have transboundary impacts.

8. We wish to express a positive approach toward solving the acid rain problem. We, as citizens, offer our continued energy and commitment toward this goal.

9. Our goal is an environment that is clean, safe and sustainable for everyone. Our intent is to insure that the principles of the Acid Rain Control Program are carried out in an environmentally sound manner. Implementation of specific technologies must be consistent with this goal.

***

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New Hampshire Natural Resources Forum

Sierra Club

Society for the Protection of New Hampshire Forests

Vermont Clean Air Coalition

ACID RAIN '84

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New Hampshire Natural Resources Forum

Sierra Club

Society for the Protection of New Hampshire Forests

Vermont Clean Air Coalition

UNITED STATES/CANADA
CITIZENS' AGREEMENT

Air pollution and associated acid rain is causing extensive damage to the environment and the health of citizens in the United States and Canada. Without immediate action to stop acid rain, irreversible damage will continue with severe consequences to human health and the economies of both countries.

Presently, both countries emit sulfur dioxide pollution, some of which travels across the border and contributes to the other nation's problems. Consequently, to stop acid rain, the U.S. and Canada must take cooperative action.

The citizens of the United States and Canada therefore urgently call upon our respective governments to establish a joint United States/Canada Acid Rain Control Program which will:

1. Commit each country to reduce sulfur dioxide emissions by 50% toward reducing wet sulfate deposition to less than 18 lbs/acre/year (20 kilograms/hectare/year) in moderately sensitive areas and 8 lbs/acre/year (9 kilograms/hectare/year) in extremely sensitive areas

2. Implement acid rain control strategies to achieve this objective by 1990 with significant interim reductions

3. Establish a mechanism to insure compliance with the stated goals and objectives of the Acid Rain Control Program.

* * *

Senator HUMPHREY. Mr. Ruckelshaus, as I expressed to you in a private meeting we had recently I am very disappointed in the administration's unwillingless to move in what I would see as a concrete fashion at this point on the subject of acid rain which is of a particular problem in my part of the country. It comes as an even greater disappointment to see this inaction as the administration proposes a bold, new effort in space. While all of us would like to be astronauts, I suppose, and want our country to be the leader in the exploration of space, we would nevertheless like, while we remain earthbound, to swim around in an environment as clean as possible.

It seems a little ironic that we have that new initiative in space on top of what we are already doing and at the same time have what we see as inaction on the acid-rain problem. You said a moment ago that you used the phraseology, wait a little longer. Can you quantify that a little bit more for us? How long is a little longer?

Mr. RUCKELSHAUS. I don't know how I can ever satisfy members of this committee who think we have waited too long already, including yourself, Senator. As I say, once people arrive at the conclusion that we know enough to do something, they almost always vent frustration with those who have not yet arrived there. How long that journey is going to take for everybody, or for the person probably most important to endorse such a program as far as the administration is concerned, where we can come up here with a suggestion is very difficult for me to predict.

All I can do, I think, in order to try to accelerate that process whereby that conclusion can be reached, is to do everything I know how to do to get this research program accelerated and to get more information up that proves or disproves the thesis that would be inherent in an SO_2 control program.

Senator HUMPHREY. You have no idea how long that will take?

Mr. RUCKELSHAUS. I wish I could. I have expressed in my testimony the same frustration I know you share about the speed of science and I am also convinced you have a frustration on the basis of others not having concluded as you have that we now know enough to move. As to when a human being is going to reach the point at which they will make that conclusion, I find it very difficult to predict.

Senator HUMPHREY. You noted that we have already lost a decade, which is unfortunate, and for which no one in particular can be blamed but we have lost that decade. Now we are going to add to that lost decade a little while longer, however much that may be, and as you noted yourself earlier it will take 4 to 8 years to design and implement State plans and then perhaps on top of that, another 10 or 15 years to reach the point where we have reduced the annual emissions by the amount necessary to produce what the National Academy of Science study concludes would be a significant reduction in the acid deposition.

So even from today looking at anywhere from 16 to 20 years before we reach that point, was there an awareness in the administration that we are facing that kind of lag before we have results that we need?

Mr. **Ruckelshaus**. There is no question there is, Senator. There is no question that once you reach the conclusion that something ought to be done, you see absolutely no reason not to proceed as quickly as possible to get it done. The delays we are well aware of are inherent in a program of this kind. And that is why I think it is so important that we understand as quickly and as well as we can what the trends are that we are talking about, I mean what kind of problem it is. Is it a longer range problem or is it one that we need to address much more quickly?

Senator **Humphrey**. You talk in your testimony of committing $5 million to restore the buffering capacity that has been reduced over the years. In practical terms what does that mean, particularly for the Northeast?

Mr. **Ruckelshaus**. It means that there will be, in cooperation with the States, a lake management program put in place in which we will both try to understand exactly what kind of management techniques, whether it is liming, stocking, whatever it might be, that can restore damaged lakes and how widespread such a program could in fact be, and would it work. As I suggest, I don't think it is a long-range solution to the problem. The administration doesn't say it is. But there are problems with that. There are gaps in our knowledge as to how successful that can be.

There have been some experiments in this country and many more in Scandinavia which have been successful. But I have seen estimates that if in fact we wanted to apply a program like this in New England or in upstate New York on a more massive basis, it would cost something in the neighborhood of $60 million.

Senator **Humphrey**. Just for New York?

Mr. **Ruckelshaus**. I can't remember whether it was New York or New England. But this program is aimed at testing out those theories, seeing whether it works and if it does, why expand it.

Senator **Humphrey**. The program of this limited scope is certainly research and not mitigation.

Mr. **Ruckelshaus**. It is both research and a demonstration of how effective the research can be. To jump right now into a $60 million—or whatever size—program, we wouldn't know how to spend the money.

Senator **Humphrey**. Does the unwillingness of the administration to support legislation at this time, instead to accelerate research, does that indicate that the administration would actively oppose legislation if it were, as it will be, initiated by this committee?

Mr. **Ruckelshaus**. What I have pledged to this committee is to do everything I can to help move this whole program toward some solution. If my expression of the administration's position as a lack of support for any of the plans that exist here implies that this means active opposition, the problem with this issue as I see it in the coming year, is that instead of moving the whole debate forward, we could polarize things so badly that it would be very difficult to address it whenever the Congress tried to.

What I would really like to do rather than get in the position of ganging up on one side or the other is to try to avoid that. If the Congress were to act and present the President with a choice of signing the bill or not, that might be a different question. That might be a form of opposition a little more clearly stated.

Senator **Humphrey**. Thank you, Mr. Chairman.

Senator **Chafee**. Thank you.

Senator Abdnor.

Senator **Abdnor**. Thank you, Mr. Chairman.

I welcome the Administrator to this committee. I'm sure you knew that this was going to be an interesting meeting for you before you came here. Acid rain seems to be an issue that is, whether we are on one side of the aisle or the other, of concern to all of us and I don't think there is anyone that won't admit that it is a major issue that we have to deal with. I guess our problems come on how we approach it. First let me ask unanimous consent to place my statement in the record in the proper place. (See p. 7.)

I know you are aware of the acid rain control program proposed by Representatives Sikorski and Waxman, financed through a nationwide energy tax. This approach troubles a great many of us in the West. Here we go again. Since our constituents would be required to contribute significantly to the cost of cleaning up the old and outdated coal-fired facilities, located in the East and Midwest, many of which are burning high sulfur coal, it may be unfair to ask you, but in your view does the resulting cost-benefit ratio differ greatly from region to region of the country or do you think it should be a uniform thing?

Mr. **Ruckelshaus**. I have heard members of this committee express their views on how this ought to be done. If you arrive at a position that an SO_2 control program makes sense, as all of you know, we are by no means home. I think as I have talked to groups all over the country, whether it is New England, the South, or the Midwest, they all state very logical positions which are irreconcilable with the positions of people in the other parts of the country. Are there elements there of some kind of compromise which could push the whole exercise forward? I guess in my head I would say yes. Are things happening which would make that likely? I think I would have to say no because what I see happening instead is people taking positions very hard and very publicly that are irreconcilable with the positions in other parts of the country. I guess I would have to believe, Senator, based on what we currently know, that assuming the Congress wanted to go forward with some kind of SO_2 control program, if the Congress were to attempt to impose very large costs of such a program on the Midwest, there would be very stiff resistance and it would be very hard to get a bill passed. So I guess one conclusion I have come to over the last several months in looking at this is that unless there is some kind of cost-sharing proposal it is very unlikely anything would happen. I can give you my view of whether that makes sense, is applicable, but I think as a practical matter not much is going to happen.

It really is a question of whether you want to make a point or whether you want to make progress.

Senator **Abdnor**. How I make the progress is where we might come into some disputes and differences. I think we could say we have a long way to go to reach some consensus as to financing once we settle on a program. I think after we get the information that these gentlemen are talking about we still have to find some way to bring everyone together on it.

Mr. **Ruckelshaus.** I think, Senator, if I were to come up here this morning and say here is our SO_2 control program, here is what we think ought to be done, that would by no means be the end of the debate. I have resolutions from the West, the South, West and Northeast Governors' Associations all saying it is a real problem, we ought to do something about it, here is our solution. None of those solutions look like they come out of the same country.

Because they are all different. How we put those together, I think—assuming we are going to go forward with some kind of program and assuming the Congress decides they want to do it—is a very real effort and what I am concerned about over the coming months is that what we are likely to see are debates occurring where it gets less likely at the end of that period that compromise will be effected.

Senator **Abdnor.** I appreciate that. I think that puts it in the proper perspective. We have a long way to go.

Let me ask you. I have been informed that limestone injection may offer some promise in terms of reducing sulfur emissions. What amount of attention is the agency devoting to evaluating this possible mitigation strategy?

Mr. **Ruckelshaus.** We are putting as much money as we know how to put into it. We put in $10 million this year and there will be $5 million next year trying to move the so-called LIMB technology forward to full demonstration. If all of the assumptions prove out on the technology, it would provide about a 50-percent reduction in the cost of removal of SO_2 and some NO_x from existing powerplants.

The biggest payoff is in the retrofit to existing boilers. It has not yet been proven out. We are pushing it forward as fast as we can to find out whether it makes sense.

Senator **Abdnor.** It does show promise?

Mr. **Ruckelshaus.** Yes; in fact we convened a scientific meeting about 4 months ago in which we went over all of the potential for technology and it was a very optimistic group. I spent about an hour with them. They had all the disciplines there involved to try to test the technology of that out. They all seemed to come away optimistic about its potential.

Senator **Abdnor.** I would be interested in that.

Mr. Administrator, until recently, researchers have focused primarily on the aquatic effects of acid deposition. Is the agency involved in efforts to examine the possible impact on agricultural effects?

Mr. **Ruckelshaus.** Yes; we have many studies going on to try to determine what effect it will have on crops. Those studies are ongoing. We have found some effect on a certain variety of soybeans. There are other varieties of soybeans where it doesn't seem to have the same effect. Some of these effects depend on the composition of the soil. Farmers obviously add all kinds of things to the soil, either to increase or decrease the acidity.

In the sulfur-limited soil it can even be helpful in some instances. But the primary effect seems to be on the foliage. It can affect growth, but those studies are——

Senator **Abdnor.** You said in your own studies. Do you know if agricultural schools, researchers are going into this area too?

Mr. **Ruckelshaus**. Yes; the Agriculture Department is involved in the national acid precipitation assessment project. They sit on the committee that oversees the effort and there are a number of studies going on in the agricultural area on the effects of acid rain.

I would be glad to give you a list of those.

Senator **Abdnor**. Let me call your office, then.

Mr. **Ruckelshaus**. Fine.

Senator **Abdnor**. Thank you, very much.

Senator **Chafee**. Thank you.

We are delighted that former chairman of the committee, ranking member, Senator Randolph is here.

Senator, do you have an opening statement you would like to make at this time?

Senator **Randolph**. I want to be cooperative with you, Mr. Chairman, members of the committee.

I would be very pleased if Senator Durenberger would go at this point if it is agreeable. Then I will make a very brief statement and then, in the questioning period, I would work with you and others.

Senator **Chafee**. Fine.

Senator Durenberger.

OPENING STATEMENT OF HON. DAVE DURENBERGER, U.S. SENATOR FROM THE STATE OF MINNESOTA

Senator **Durenberger**. Thank you, Mr. Chairman.

I thank my colleague from West Virginia who did an outstanding job this morning while others were kicking off this hearing. May I have a brief minute for an opening statement as well as questions?

Senator **Chafee**. Certainly.

Senator **Durenberger**. On the issue of polarization, Bill, let me just quote; I hate to quote myself.

Senator **Chafee**. Who is better?

Senator **Durenberger**. Talking about the whole issue of what we know, we don't have precise measures of acid deposition, wet, dry, trend lines stretched back over decades. We don't know the atmospheric chemistries that convert SO and NO into sulfur and any trick acid.

We don't know how these acids are buffered by elements in the soil, how acidity reaching fresh water interferes with the respiration and reproduction ducts and whether it is permanent, whether emissions reductions in one point will increase the range of P.M. precisely at another. That is sort of an illustration of a litany that is being played in certain parts of this country today about acid rain.

The bottom line always is more science, more research, let's get the answers to those questions. I keep asking myself the question even if I have all, what difference does it make if I have the answer to those questions?

Do I really have to know the precise chain of chemical, physical, and biological processes that carry a ton of sulfur from a powerplant in Ohio, to a lake in New York in order to know what to do about acid rain and what kind of action is needed now. Because I already know that the atmosphere over our continent is loaded with millions of tons of sulfur dioxide, nitrogen oxide each year.

I already know that the larger share of that loading, 90 percent in the case of SO_2, is caused by man and his industrial activities. It is manmade pollution. I already know that sulfur dioxide is an air pollutant, can produce negative health effects in the young, and those with respiratory diseases because we already have made a commitment here to control it as a conventional pollutant under the Clean Air Act.

I already know that sulfurdioxide is converted to sulphants that reduce visability across the eastern half of our continent and across some very magnificent vistas in our west.

I already know that acid deposition damage is building up on crops and forests directly. I already know that waters that are acidified by deposition of air pollutants mobilize heavy metal, carrying them to sensitive environmental resources and into the food chain.

I already know where the problem comes from, a very large share of the sulfur dioxide is produced by stationary sources that I can find on a map of the United States and I can pinpoint them.

I already know how to reduce those emissions. The technology is not the problem. It is here now and it is very effective in removing large percentages of the pollutants we care about. That is the best way I can illustrate some of the polarity that exists.

About an hour ago, you are going to hear this in the future, those of us who were late to this meeting heard the President of the United States tell us the little story of the fourth century monk, who, I forget what little village he was in, but as was the religious custom of that day, at some time in his life, he had to make a pilgrimage to Rome. So he made the pilgrimage to Rome at a time when there was great festivity. Everyone was at the colosseum to watch the gladiators.

This little monk came into the colosseum and there are tens of thousands of people there cheering and he gets a seat in the arena and he sees the gladiators come out and they get up in front of the emperor and they salute him with their swords and they say "In your honor, to the death."

They are willing, you know, to fight each other to the death for the honor of the emperor. And the monk sits there astounded and he says for God's sake, stop. And nobody hears him, of course. They are all cheering the gladiators. So he makes his way down into the arena, during the fight, gladiators, swinging at each other, saying for God's sake, stop, for God's sake, stop.

And in the beginning, the crowd starts to laugh. They think it is a clown or something like that. But then as he gets close to the gladiator, he distracts the gladiators from their task of killing each other.

The crowd turns on him. And one of the gladiators strikes a sword into him. He kills him. He is falling to his knees in the sand of the arena, he says "For God's sake, stop." And the silence falls over the whole arena.

One person gets up out of the seat and walks out of the arena. And then another person, another person, another person, and that was the last time in Rome they ever fought to the death.

Mr. Administrator, whether it is ethylene dibromide or acid deposition, somebody has to say stop. The question before us, obviously, is how we are going to go about arriving at the stop decision. You were kind enough to solicit from me in December my views on what the President might say in his state of the Union. And I recognized as you did that if he came to us with a control strategy, as you just pointed out, as you walked in here with a specific control strategy today you would just be another actor in this conflict that we are going to see played out here about exactly how to do it. But what I suggested in my letter to you which I will make part of the record is that the President might at least tell us "For God's sake, stop."

At least that, for God's sake, stop. I haven't heard that yet from the President. And then he might suggest to us what it takes to get us moving so we can. So we can stop.

It occurred to me that the best place to get started on this is the same place as we are going to have to get started on tax reform, all of the other things we have in the next year, is by agreeing on some basic set of principles.

Let's not start at the end which says emissions taxes are better than regulatory or electric taxes are better. Let's not start at that end. Let's start in the beginning with some general set of principles.

So very simply in the letter that I sent to you, I stated or suggested three principles.

My questions will be around those principles. First, any acid rain control program should be a national program, emphasizing least cost solutions across all States rather than a State-by-State program that allocates reductions by the use of an averaging process for a uniform cap for a mandated technology. That is my suggestion.

Second, an acid rain control program should include an acid mechanism, a tax, grants system so that the burden of controls is shared equitably among all who contribute to the acid rain problem.

I might add that a poll in my State recently indicated that when people are given their options of where to go to get money to stop this program, 70 percent said the polluters and 2 percent said electricity.

Third, the financing mechanism should give credit for expenditures already made by some to control sulfur dioxide and nitrogen oxide emissions. So with those three principles in mind, Bill, I would like to ask you, there is an assumption I make that we are going to be writing a control bill here of some sort in a couple of weeks. And I appreciated what you said to Mr. Humphrey.

I guess that is where we are going to start, we are going to probably write a bill of one kind or another. There are several bills pending. They all allocate reduction responsibilities in different ways.

John Glenn's bill, sets a uniform cap across all, the Waxman bill mandates distributers, the bill reported in 1982 by this committee allocates reduction according to a formula that counts emissions in excess of 1.5 pounds per million Btu's.

My question to you is whether you have looked at these various approaches from a least-cost perspective and in your estimation, do any of these approaches approach cost solutions or do they miss the mark in some way?

Mr. RUCKELSHAUS. Senator, as I listened to your story about the monk and his recommendation "For God's sake, stop," I thought about taking that story back to the President.

On the other hand, I would have to be clear that I was not suggesting he take the place of the monk in the story given what happened to him.

The least-cost approach certainly has a lot to recommend it equitably. And the problem, of course, breaks down into the opposition that will take place toward such an approach from the high-sulfur-content coal miners and companies that are involved in that. If I had to describe the spectrum of opinion—I have listened to 100 people, individuals and groups as I mentioned in the beginning of my statement—the strongest opposition on the one side is from the high-sulfur-content coal miners, probably the other side is represented by environmental groups, people in New England and southern Canada concerned about this and your State.

If the opposition of those high-sulfur-content coal miners and interests in the Midwest is sufficient to stop any control program from going through the Congress, that does affect the principle.

I have no quarrel with it as a principle. In fact, I think it is a good principle and one we ought to employ whatever the public policy is. And it could be that there is an element of some compromise that could occur where you adhere as best as you can to that principle and recognize that these are real people, the coal miners.

I have talked to them personally. They are not bad people. They are really worried about what is going to happen to them. Their response to it is that a lot of science is all nonsense, there is no problem. But they are really very concerned about their future.

Needless to say, any cost-sharing program that is suggested that will apply to the West is not going to be something that they will immediately embrace. It has two elements to it, one a further protection of high-sulfur-content coal at the expense of their resources and, second, some provision that they ought to pay for that protection that adversely affects them.

So I think that least cost certainly has appeal to the western part of the country, and strong opposition will come from those parts of the country where high-sulfur coal is.

Senator DURENBERGER. Take out the coal, the jobs issue and compare it in emissions tax, such as S. 2001 with my bill as the other, the least cost means you get every dollar working for you.

You are not basing any dollar. Isn't, then, emissions tax much closer to a least-cost approach than any of the other approaches that have been succeeded in your opinion?

Mr. RUCKELSHAUS. I don't know if the emission tax itself necessarily gets you to the least cost. It could have the effect of impacting those who would have to reduce SO_2 considerably twice—both in terms of the expenditure for reduction, and the payment of the tax itself.

If you are talking about a Btu tax, which is a much broader kind of base tax, that, at least while it hits the people who will have to make the reduction, assuming the revenue is used to cover the cost of control it doesn't have the effect of hitting them twice.

Senator **Durenberger**. But to make an emissions tax work as the least-cost approach, a couple of things are necessary.

First, to get a tax out of here you are going to have to address the jobs issue. There is no question about that in my mind. We have to concern ourselves about the jobs.

The second issue evolves around whether or not you have the capability or whoever might be designated, someone has to be designated the job of identifying those 150 or 200 retrofits out there that are the ones that give us, you know, every dollar working.

In each case, we have to run to someone like you. Is it possible in your opinion for your agency with some instructions from us on the jobs issue such as something relating to fuels switching or whatever, is it possible for your agency to help us address that job question and, secondly, is it possible for your agency to do the job that is necessary to maximize the expenditure of those tax dollars in the 150 or 200 or whatever it is retrofits that will do the best job?

Mr. **Ruckelshaus**. As an administrative matter, the answer to your second question is yes. Can we identify a least-cost approach? Yes; and we have got very detailed studies that have been done on how this can be done at least cost, some of which have already been made available to the committee.

I think that is fairly clear. As to the mechanical manner of how you go about doing it, you might differ in certain aspects. We can go down exactly what the cost per dollar, per ton, would be to remove with various technologies.

There is an overlap, for instance, between coal washing and scrubbers at one point. You can get a lot of coal washing but at the higher end of the technology, it starts to get very expensive.

To address the first part of your question, can we help on the jobs issue, we can give you the analysis we have done on the jobs issue. Whether we can help you with it or not I don't know; EPA doesn't have very much experience on that.

Senator **Durenberger**. I may have other questions that I will submit.

Senator **Chafee**. Senator Simpson.

OPENING STATEMENT OF HON. ALAN K. SIMPSON, U.S. SENATOR FROM THE STATE OF WYOMING

Senator **Simpson**. I said once to one of your predecessors, welcome to the pit. We do not have a stock or pillery here in this Chamber, but I have often thought perhaps we could install it there at that particular table.

I must refrain. It is like the old theme, here we go again or don't blame me, or one of the others.

Here is my situation: If I wanted to be magnificiently provincial, I would just sit here and do absolutely nothing and watch them fight, because America will turn toward low-sulfur coal.

Somewhere in this process they will turn to low sulfur coal. At least if it is done fairly, it wasn't once when we had a remarkable thing called percentage reduction. We haven't really had the debate on that yet here in this committee. That will come. That will be a doozy because that was terribly political in the midst of clean air, totally provincial. As I say, I could sit here but I won't, since that is not my nature.

But somewhere we are going to set a limit. I agree with Dave Durenberger and George Mitchell, everybody in this room and John Chafee and my dear friend, Jennings, all of us, are going to set a limit and I will vote for it. Then I hope we will allow people to get to that limit however they can, whether it is through scrubbers or coal washing or acidification or splashing or disguising the stack.

And then you say, here's the limit, you just get there. I hope we can do that. I want to do that. I hope you will all agree that we will want to do that. I think it is a serious issue. We are getting some studies together; the Forest Service is working on it and not only do animals die in the wild west, trees die, and lakes die. They have been dying for years.

We don't know why. Pollen does it sometimes. This will do it apparently. But the problem here in this committee and it is a remarkable group, is that we have not yet heard from anybody from Ohio or Indiana or Illinois or Missouri. So we sit here and pass this out of here, 16 to SIP because none of us want to look too evil. And none of us are really affected.

I mean in the gut hard business of running a State, getting severance taxes, having industry and jobs. So I cannot wait for the debate on the floor of the Senate which will consist of my good friends, Howard Metzenbaum, Chuck Percy, Levin, Danforth, Lugar, Quayle, and Dixon all on the same side, wondering how to control a ghastly situation in America, how to save the land of the country.

That will bring a new dimension to the debate that has not yet been heard. It will probably be a more reasonable debate and certainly not a partisan debate. I don't think we will drag up those from the EPA's of the past in the process. Then you know we talk about our neighbor, Canada and their rich feeling and depth and yet they don't have a lot of scrubbers on their stuff up there. Then they compete across the river with the utility in Detroit because they can do it cheaper because they don't have to have 99 percent pollution control. They might get started and try to do 50.

In a few years they will be at 90 and they are asking us to get to 100. There is lots of stuff in this one that has to do with reality and the easiest thing, I guess, the reason I am so emaciated, shattered, is that I deal with these issues like immigration, nuclear regulation, and veterans affairs, all of them filled with guilt, fear, emotionalism, racism, then it takes thoughtful people to come along behind and police up after those guys.

That is where we are. The Northeast has problems. It is not immune. You burn high-sulfur fuel oil up there, crude. That pollutes to beat hell. That is in the Northeast. That causes fly ash and causes the things they have discussed. We know that there are trace metals in all of that area, caused by burning of that kind of a fuel.

It will not do well to polarize this one. I can see that is just where it is headed again. I can only say I promise you I want to do something. I come from a State and, boy, did I get "unshirted hell" when I was in the legislature.

We worked for a bill to make the SO_2 requirements in Wyoming six times more stringent than the Federal Government. We passed that. It wasn't very popular. But we are going to get polarization here.

You have shared with me, Bill, and I admire you greatly, how you have this tremendous polarization already in one area, where you have uranium mill tailings. We deal with that on this committee. We will come to that; radon emitting materials and piles and you know the polarization.

The one side says that if a human walks over this ground he will be immediately sterilized and the other side says that the antelope eat the grass on the top of the dirt and it strengthens and nourishes their body.

If we are going to get into that here, we ain't going to get the job done. I hope we don't. Now I have a question.

I know what you have done in studying the aspects of acid rain. I know that the people right in your own agency get in a room and they scrap like dogs right across the table from each other on this issue. But in your studies, in your own thoughtful way which I know is real, and you look at every aspect of this, scientific, economic, political, in your best judgment of what you know now, what are the fundamental elements that we here at this table and in the U.S. Senate should put into acid rain legislation to result in any kind of sound public policy?

Mr. RUCKELSHAUS. Your question has to assume that you have arrived at the point at which you decide you want to move SO_2 emissions down. That, of course, is a fundamental question before the committee and that is an issue which has divided the administration and the committee in the past. If you assume that is where you are, it does seem to me there are some elements that would have to be involved in order for it to be successful. In the first place, probably wise public policy would involve trying to test out, as much as possible, these theories as to what exactly is happening in an empirical way and test the models that we have that are predicting what the effects of the emissions are on various lakes, forests, and sensitive areas so that before we went into a very large, very expensive program, we would have a better understanding of exactly what we were going to get for it.

That is one approach. It seems to me that if you decide you are going to go forward with an SO_2 control program, it might be advisable. But at the same time you were doing all of this monitoring that I discussed in my statement to understand whether we were in an emergency or not, whether we had a longer term problem on our hands, so that if you decided at some point along the way while you were doing this testing that you needed to take the levels down more rapidly, you could always do it. You could have the administrative machinery in place to accomplish that. Assuming that is what you wanted to do, the first successful element of any such strategy would have to be choosing an area in which it were going to take place; that is, in which an experiment is going to take place. Asking the people in the area, even if you chose an area as broad as 31 States who were dramatically affected by it, to pay for the whole thing, I think at this point as a practical matter, even though it might make sense as a matter of public policy—the polluter pays principle—would raise so much opposition that I don't think anyone would have it.

Do you have a deadline, Mr. Chairman?

Senator CHAFEE. Yes; does that complete the answer to the question?

Mr. RUCKELSHAUS. No; but it begins it.

Senator CHAFEE. What point are we up to now?

Mr. RUCKELSHAUS. He asked me what elements I thought would be successful.

Senator CHAFEE. Why don't you finish up the answer.

Mr. RUCKELSHAUS. I think you need to accommodate the various interests that are involved in this debate, whether it is low-sulfur-content coal, high-sulfur-content coal, the effect it would have on miners, on the ratepayers in the Midwest, the benefits that would be achieved in the Northeast, all of those things have to be accommodated to one another, including the problem associated with the growth. Whenever you try to set some kind of SO_2 cap, in a region as broad as the 31-State area in this country, there are States, for instance, Louisiana, which produces almost all of its energy with natural gas, and they have plans for using more coal as do a lot of Southern States. How you accommodate for those plans and allow them to grow on some reasonable basis and at the same time give them an SO_2 requirement is something that will take a lot of attention and will take good will on every part of the country if you are going to move the whole thing forward.

Those kinds of discussions have to go on and they are currently not.

Senator SIMPSON. Mr. Chairman, I will cease. I just wanted to——

Senator CHAFEE. If you have a short question go ahead.

Senator SIMPSON. It is very short. The answer may require written information. But one aspect of it is seldom discussed is the generation of the scrubber sludge. There is a product left over when you scrub through America and we will have to do that. Do you feel the EPA and Congress may attempt to solve this and we will begin our solution? I promise to be hopefully productive in that, but aren't we going to create another environmental problem in the form of land disposal of large vast quantities of potentially dangerous scrubber residue or sludge?

Mr. RUCKELSHAUS. I often think, Senator, of the analogy of Harry Truman, when he was President, who had a sign sitting on his desk saying, "The buck stops here." If you equate pollution with the buck, the trouble is the buck doesn't stop anywhere. You take it out of the water and put it on the land and then nobody wants it there. If you take it out of the air, put it on land, nobody wants it there. It keeps bouncing around from media to media causing problems. Sludge is a problem—the residues that will result from wet scrubbing—as to how you dispose of it, how we take care of it. We are in the process under the Superfund law of cleaning up literally decades of neglect, careless discard of hazardous substances of all kinds.

What we have found in the course of cleaning up, to begin with it is about 100 times as expensive and potentially harmful as if it is anticipated. The sludge is a problem and one we would have to deal with effectively. It is a major cost, I mean talking about just paying the capital costs of scrubbers just doesn't get to the whole cost by any means. The operating cost is a major cost.

Senator **Simpson**. Thank you, Mr. Chairman. I appreciate it.

Senator **Chafee**. Thank you.

Senator Randolph.

Senator **Randolph**. Thank you very much, Mr. Chairman.

This will not be of interest but I want it on the record. Sometimes I wonder how long I have been in this committee and how long I have been on the Hill, but I do say after listening to Alan, I served with your father, and he was a mighty good man. I consider you also eligible for that category.

There are differences of opinion of course. This will not serve any good purpose but I want to make it on the record. Out of this committee, ladies and gentlemen, have come over the years some of the most constructive legislation that has ever been drafted, labored into law because of the work done here, exacting work by subcommittees and the full committee over a period of time. I will not list these legislative firsts but I do speak of this committee and of its members through a long period of time.

I want to say, Alan, I know you will understand this, West Virginia likes to be first when something is good and perhaps last when something is bad. This is not a good or bad for the moment. But we face up to the fact that last year Wyoming replaced West Virginia as the second largest producer of coal. Who would have thought that 10 years ago, 15 years ago? The output in your State has grown rapidly while in West Virginia we are trying mightily to protect our markets and reduce unemployment in the coal fields where we have 40,000 miners today without jobs. So on the record I want this to be simply a statement of fact.

Mr. Chairman, I want to cooperate timewise. This is a crucial set of hearings but to save the time and to preserve the flow of questioning I will ask unanimous consent that my opening statement be placed at an appropriate place. (See p. 7.)

It does restate my agreement with some other members of the committee and also I think basically the earlier statement before this hearing of Mr. Ruckelshaus; that is, that acid rain is a very real problem. It is of very deep concern in West Virginia and certainly in other States. Our statement generally reviews these problems and these concerns and many of the proposals are set forth in the quality of evaluation. Some of the matters that we need to develop before we actually would move. I have voted many times in the past on this specific subject matter.

Now for a question: One of the issues relating to acid rain is the quantity of additional research needed to further our knowledge. I know that our able colleague, Mr. Durenberger, referred to certain knowledge that was already on the record. I commend Senator Moynihan because he has had initiative. Back in 1980 when he worked for legislation to carry out such research that has been mentioned, that work is not passive. It is now underway. I, and many others who wanted to accelerate it, have indicated our support and our desire to have that happen. In addition to accelerated research and of programs to mitigate the effects of acid rain, a bill that I have introduced also contains a limited cap on growth of sulfur emissions.

Wouldn't it be desirable to have conservative control of any growth in sulfur emissions while we study, what I believe to be reasonable corrective action on the subject of acid rain? It seems worthwhile to me at least in part, Mr. Chairman, to avoid increases due to changes in State implementation plans and also to restrict any growth except where it meets what we call new source performance standards.

Mr. Ruckelshaus, what are your suggestions on what I have said?

Mr. **Ruckelshaus**. Senator, the current law provides that any new source that comes online has to put on the latest and best available technology. In fact, one of these projections for the reduction in sulfur oxides in many of the Midwest States has to do with the retirement of older plants and construction of new coal-fired plants in which the emissions will be 90 percent or better less than they were in the uncontrolled plants, regardless of the sulfur content of the coal. So that is current law. There is, of course, the question about when all of that is going to take place, how long out into even the next century when that will really occur.

I have explored a couple of things along the lines you are discussing. No. 1, what can we do under the existing law to control sulfur oxide expansion between now and any time the Congress or the administration may decide to move forward with the control program?

There are infirmities in the existing law in doing that. There are difficulties in doing that. One of them was alluded to earlier by Senator Chafee when he indicated how much we have permitted SO_2 to increase by agreeing to amendments to the State implementation plans. Those increases have taken place because under the health based SO_2 standards—which is the way we are currently controlling SO_2—we cannot show any violation of the ambient standard that the State implementation plan would permit by allowing the growth of SO_2 to increase. That is troublesome in terms of trying to hold SO_2 levels constant. There are provisions under the current law which we could interpret in such a way that it would hold levels constant or even take them down. They are in my judgment tortuous interpretations of the current law and it is very hard to justify those interpretations given the purposes for which they were written, which didn't have anything to do with acid rain, and the purposes for which we would be implementing them.

I would feel much more comfortable as the Administrator of EPA if I had from the Congress some kind of suggestion as to how to do this, as opposed to trying to take the current law and, in my view, at least, twist it in order to achieve that objective.

Senator **Randolph**. Mr. Chairman, I ask Mr. Ruckelshaus further whether he thinks that beyond reasonable effects and technical controls, that it might be helpful to have studies and methods to alleviate the impact of a controlled program on employment.

Employment has properly been mentioned. Such methods might include alternate control strategies, or the provision of adjustment assistance to communities with displaced miners and other workers.

Has your agency, Mr. Ruckelshaus, conducted any studies or is there a contemplation of studies on how to cope with the employment impact of certain types of control of acid rain?

Do you plan any?

Mr. **Ruckelshaus**. Yes; we have done quite a bit of work in that area, Senator. I would be glad to share it with you. We have looked at the potential employment impact of a lot of different control strategies, different control scenarios and we have examined ways of alleviating some of those potential impacts.

I would be glad to share that information with you.

Senator **Randolph**. Thank you.

Mr. Chairman, I said I wanted to be helpful in the matters we are discussing. I have two more questions but there is no reason why I cannot have those before Mr. Ruckelshaus for answering later or make them a part of the record. I also recognize the matter of timing. I will defer them at this point; is that agreeable?

Senator **Chafee**. Why don't we take them?

Senator **Randolph**. The 1977 amendments to the Clean Air Act included, as you know, Mr. Ruckelshaus, provisions for controlling emissions in one State, which effects another State.

I authorized that amendment because of my concern that emissions from Ohio, very frankly, made it difficult to attain clean air in West Virginia.

Have you explored ways to use the interstate air pollution provisions in the control of acid rain?

Mr. **Ruckelshaus**. Yes, we have, Senator. We are continuing to do so because we have been given 60 days notice by several States along with some environmental organizations that are going to sue us if we don't proceed.

The problem is the same problem we have with relating these sources to the receptor areas with acid rain in general. Before acid rain comes down in a form that we don't like; that is, as sulfates, it changes from sulfur oxide to sulfates. If we were to set ambient standards in the receptor area based on the sulfate deposition, it would have to be done under the particulate matter standard. That is one of the recommendations being made. Frankly we don't know how to do it, because we don't know how to do the long-range transport models and then relate the ambient standard back to the source.

We have made that same admission of scientific infirmity in court after court where we have been asked to impose such a standard and the courts have always upheld our inability to act.

We are in that same condition with these 60-day notices that we have received to act or they will proceed against us where we have an ambient violation.

The case of Ohio polluting West Virginia is a different question. We can insure that the Ohio State implementation plan avoids an ambient health-related or environmental related, welfare related violation in West Virginia.

We have done that in State implementation plans across the country. Where we are talking about acid rain and the long-range transport kind of problem, we have a much different order of complexity under the current law.

Senator **Randolph**. Indulge me 30 seconds and then I am through. We have a concern in West Virginia about the cost of electricity. It is increasing for major industrial users. This might result from acid rain control. I say that one industry in West Virginia which depends on what we call the dedicated power from a nearby coal-fired generating station, estimates its electrical costs would rise by 25 percent. This could make its continued operation noneconomic, especially if similar costs were not imposed, Mr. Ruckelshaus, on its competitors in Indiana or other States.

Do you have any studies on that subject?

Mr. **Ruckelshaus**. I would be glad to stipulate that if a utility in Ohio were forced to pay 25 percent more than a utility in Indiana, it would have competitive problems with that utility in Indiana.

Senator **Randolph**. Thank you, Mr. Chairman.

Senator **Chafee**. Thank you.

Senator Burdick.

Senator **Burdick**. Mr. Ruckelshaus, thank you for your testimony. It seems to me that if this problem is not national in character, it is continental, we have heard the differences here between the States and one of the Senators referred to Canada.

I want to know what has been done diplomatically with Canada. I know of one plant that is 3 miles north of the North Dakota-Canadian border that with the prevailing winds spews the material over my State. I understand that there is another plant in the neighboring State of Montana.

I am also told that there isn't a plant in Canada that has a scrubber. Don't you think if we are going to move on this area where we find there is no respect of State boundaries, wind and wind currents, there is no respecter of national boundaries, shouldn't we have some contact with Canada through our State Department or somebody that can keep them aware of our problem and what they have or haven't done?

Mr. **Ruckelshaus**. Senator, since returning, I have been in constant contact with my counterpart in Canada, Mr. Caccia, who is the Minister of the Environment, and I have been in contact with Mr. Gottlieb who is the Ambassador from Canada here.

I have talked with the Secretary of State about it. I have been to Halifax for a joint meeting where the external ministers in Canada and Mr. Schultz and myself and Mr. Caccia, were discussing all of these issues.

As you know, the Canadians are very concerned over the problem of acid rain. I have tried to work as cooperatively as possible with them. I have been very frank with them that there are people in this country concerned about what they are doing about it, when we are being roundly condemned by the Canadians for our lack of action.

They are aware of that. They are aware of those concerns. They do feel they are moving forward on controlling SO_2 and NO_x emissions. They have expressed a willingness to proceed on a more aggressive basis if there is a reciprocal agreement on our part.

The administration at this point not being willing to endorse an SO_2 control program is in some difficulty discussing with the Canadians what they ought to do when they have expressed a willingness to reduce it by 50 percent. Given all of those infirmities of our various positions, given the fact that there are, I think, legitimate arguments that can be made on both sides, I have tried very hard to keep open the communication between the two countries and I will continue to do so because I think it is an issue that right now very badly divides us.

Senator **Burdick**. I haven't seen any movement on their part to retrofit of any kind.

Mr. **Ruckelshaus**. I don't think in the cases you cite that that is happening. They have taken some action in the single biggest source of SO_2 in Canada; namely, the smelter in Ontario.

Senator **Burdick**. That is one with the 1,000-foot stack?

Mr. **Ruckelshaus**. Yes; it has been a very big emitter, up to 7,000 pounds a day of SO_2. It has been reduced down to something like 1,900 pounds. Part of that was because one of the units was shut down. Another part of it is they have taken some action to reduce those SO_2 emissions.

Senator **Burdick**. As a neighbor of Canada, I like to keep good relations but I don't like to see this country go to the stream of doing all we can, when there are laggards up there.

Mr. **Ruckelshaus**. Senator, if we were to address the acid rain program, if Congress and the administration decided they knew enough to address the acid rain problem, there is no doubt in my mind it would have to be done in conjunction with the Canadians.

That is essentially what they are saying right now. I think we can go back and look and see who has done what in the past. If we had any agreement between ourselves and the Canadians as to what ought to be done in the future, obviously we would have to go back and see what kind of effort has been made in the past.

A considerable effort to reduce sulfur oxide emissions has already taken place in this country. We have over 100 scrubbers on both new and old plants in this country. We reduced SO_2 emissions considerably nationwide and in the Midwest. This has been a result of the law that Senator Randolph justifiably praised as passed by this committee in 1970, the Clean Air Act. It has worked. It has taken sulfur oxide down. It was aimed at protecting public health, and protecting welfare effects.

It was not aimed at the problem of acid rain. It is not a very good instrument to deal with that problem and what we are currently debating, discussing in this country is whether that act or some law should be amended in order to deal with the problem of acid rain.

Senator **Burdick**. I hope that you and your department or the State Department will continue discussions with Canada because I think it is very important at this time.

Mr. **Ruckelshaus**. I think the point is well taken, Senator. I think just as Senator Durenberger suggested, and I have heard other Senators amd Representatives from the State of Michigan, from the Northeast amd from the West suggest that there should be some credit given for effort already made.

I think that same kind of discussion would need to take place between this country and Canada if we got to the point of actually trying to craft an agreement between the two countries.

Senator CHAFEE. Senator Baucus.

Senator BAUCUS. Before I turn to acid rain, one quick diversion. I see Assistant Administrator Joe Cannon sitting behind you. He, as you may know, came to my turf a few weeks ago to study wood smoke pollution problems in our State. I want to tell you, we were very impressed with him. He is one of the more able Assistant Administrators I have ever come across in the few years I have been sitting here in the Congress. I know he will talk to you about the problems we have in Missoula, Mont., and I hope you will listen very diligently to him because we have some real problems.

Mr. RUCKELSHAUS. I didn't know Joe Cannon was in Montana. I am glad he was engaged in worthy work while he was there.

Senator BAUCUS. Turning to acid rain, I have really two points to make. First, I want you to know, if you don't already know, that in Montana there has been some recently constructed coal-fired utilities called coal strip 3 and 4 not completed yet. That project will cost $1.7 billion. The consortium has spent and will spend $500 million out of that total cost on pollution control equipment to be class 1 Clean Air Act standards. As a consequence they will cut down their SO_2 emissions to 0.07 pound per million Btu and that results in about a 20-percent increase in the average Montana utilities' consumer bill. I want to contrast that with the emissions of other plants in the areas of the country we are talking about. We emit SO_2, as you know, in the neighborhood of about 4 or 5 pounds per million Btu, the standard is 1.2 per million. We are trying to strive for 1.2 pounds per million Btu. That means that we in Montana are 100 times cleaner, 0.07 compared with 1.2. We are over 100 times better in cleaning up SO_2 than these other plants being constructed.

I raise all of this because there is a proposal in the other body to oppose a 1-mill-per-kilowatt-hour tax on all energy produced, coal-fired generators, I think hydro, I think nuclear is exempt. The point I am making obviously is that is just not fair. We in Montana are cleaning up our air. We are enacting very strict standards, 0.07 pound, to meet class I Clean Air Act standards and we think it is grossly unfair to adopt in the Congress and in the country a 1-mill-per-kilowatt-hour tax where we have to begin to clean up these other plants with the pollution they are causing.

My question is, Don't you think that is unfair?

Mr. RUCKELSHAUS. If I thought fairness had anything to do with the solution to the problem I don't think we would all be here. There is no question that your argument is well taken. The same thing is true, by the way, in the Midwest of any new coal-fired powerplant that is built. It has to meet new source performance standards, just as the coal strip plants had to meet in Montana. Those plants have to put on scrubbers regardless of whether they use high- or low-sulfur-content coal under the 1977 amendments to the Clean Air Act.

That is just what Senator Simpson was complaining about a little while ago. In one respect, that scrubber requirement is inhibiting the retirement of existing plants in the Midwest because it costs so much, just as you suggest, to build a new plant that they do everything they can to keep the old dirtier plants going. If we had some way of encouraging them to move into new plants, which are much more highly controlled, much less pollution-intensive, it would be something for this committee, I think, really to consider seriously. But the opposition, as you suggest, that exists in the West to paying for what you have already done and what might be done in the Midwest is very strong.

I have run into it everywhere I have been in the West. The opposition to doing it on their own in the Midwest is equally strong. It is usually expressed as we don't really think there is a problem, but if there is a problem, it certainly ought not to be up to us to pay for it because we don't get any benefit for it. The benefit all accrues to the Northeast, and therefore the Nation ought to pay for it.

Senator BAUCUS. I am glad you agree the argument is well taken.

Mr. RUCKELSHAUS. That is exactly the argument I would make if I were from Montana.

Senator BAUCUS. That is why I am making it which leads to my second point; namely, we have to get together in this country. You sent me a Christmas card. I thought it was one of the best Christmas cards I have ever received from anyone. As you will recall the Christmas card, man and a wife, presumably, just a man and a woman, holding an umbrella.

Mr. RUCKELSHAUS. That was my wife.

Senator BAUCUS. Jill is more attractive than the lady on the card. The man and the woman, you and your wife, holding an umbrella, with acid rain coming down through the umbrella, and different pH's and so forth and I am not a chemist, I don't precisely know what that meant, but obviously the question is we have a real problem with acid rain. So I know your commitment to the problem. I also know your commitment because a year ago you said your No. 1 problem is how to address the problem of acid rain. So I am hoping that EPA will provide some leadership. We know that there are parochial, points of view here. Certainly there are. I am committed to protecting Montana from the Western point of view.

We need some leadership from EPA. Senator Simpson has said that he will vote for a limit. This committee probably will do so. But we need the leadership of the EPA to help us forge a solution together.

Without the EPA's help I doubt that we are going to get a bill passed. I think we all know that we need a bill that does set very strict limits because we know we have a problem here. We don't know all the answers. We know we are sure we need some more research because basically we have had enough research to get on with it, to find the solution that meets the problem. So I hope the EPA provides that leadership.

Mr. RUCKELSHAUS. Senator, you want me to reply? I think as I have examined this problem and traveled around, it is difficult to envision how these different points of view are going to come together. Some mechanism has to be found to try to pull all of these disparate interests together and see if it is possible—assuming you are going to go ahead with an SO_2 control program of some kind—disparate groups together. I think EPA can provide some of that help, some of that leadership. One of the things I have suggested to the committee in my statement that I think we can do at this point is push as hard as we can on these gaps in our research effort that will advance our knowledge so we know better what it is we ought to do.

But I wish I could be more optimistic in suggesting that EPA or my ability alone were going to be able to pull all of these disparate interests together. I think it will take a lot of good will on the part of a lot of people in order for that to happen.

Senator BAUCUS. I understand but I think the EPA and the administration together could wield a lot of influence and if the will is there you could form a good consensus to address the problem. I am calling upon you to put even more pressure on the administration to back you up the way it should and has not been doing thus far.

Senator CHAFEE. We will start our second round.

Mr. Administrator, it seems to me that the thrust of your testimony this morning has had accent on the research; we have got to find out which direction we should go, what to do.

Let's not plunge into this thing too quickly and, yet, my question to you is, are we reinventing the wheel? It seems to me that in Europe, West Germany, Sweden, they have dealt with this problem for some time. It is my understanding that based on its research, the Federal Republic of Germany has taken the lead and made some very drastic reductions in their sulfur emissions.

Is that so? Are we taking advantage of the research that has occurred in Europe?

Mr. RUCKELSHAUS. Yes; we are, Senator. We are actively engaged through this research effort here. There is a summary that I have already read of these reports that I would really urge the members of this committee to read because there are gaps in our knowledge which, whether we decide to go forward with an SO_2 program or not, really ought to be filled.

We are working very hard with the researchers and scientists all over the world to try to better understand these problems. The truth is nobody at this point with the possible exception of the Japanese, has done as much to reduce SO_2 emissions as we have. They have very large emissions in Germany. They are embarked on a program to start to address them. We have done it, not for purposes of acid rain, but for purposes of public health and welfare controls, under the Clean Air Act.

Into the future, all of this will take hold as these older plants retire and these levels are going to come down very, very far. But the question is, is it too far out in the future to address this problem that we have here today?

We are working very hard with our scientific counterparts in Europe to try to understand what they are doing. The thing that is driving the issue in Germany more than the lakes is the forests. They have a lot of forest damage they have identified. It is of great concern to them. They have the same questions we do. They suspect the acidity of the rainfall but they don't know whether it is that, whether it is the metals, whether it is the ozones, whether it is drought, or some combination of all of those things or some natural cause that is causing the problem.

They are working very hard at this. They have embarked on a program to bring those levels down. The pH levels of the rainfall in the areas of Germany where this is occurring, are around 3.8, much lower than they are in the Northeastern part of this country. So it is a problem that has gripped the public there and the Germans are moving forward on it as are other European countries. But they are having the same sort of devisive discussions we are having here, with Scandanavia being way out in front, deciding something ought to be done about the problem, England being more like the Midwest, Germany is really very much like Pennsylvania, schizophrenic about what should be done, being both a receptor and a source of the emissions.

Senator CHAFEE. This gets to the point that we have touched on here today; that is, the SIP's and those States that have achieved the attainment goal which are directed toward health. Yet as has been pointed out, the sulfur tonnage emissions have increased by something close to 2 million tons.

Mr. RUCKELSHAUS. 82,000. It is actually closer to 100,000. Actual increase.

Senator CHAFEE. Over what period?

Mr. RUCKELSHAUS. Over the period from 1981 to 1983. I can give you this.

Senator CHAFEE. All right.

Senator MITCHELL. As opposed to allowable increase?

Mr. RUCKELSHAUS. That is right. That is the actual increase.

Senator CHAFEE. All right. I am not going to quarrel over the exact tonnage at this time but it seems to me the problem we have here is everybody recognizes that the discharge of sulfur is a problem and, yet, because the SIP's are health oriented and some of these SIP's are fairly loosely drawn, I suspect, but nonetheless, some States are allowed greater emissions because they are not in excess of their attainment goals.

Haven't we got a problem there? Haven't we got a loop-hole in the law that we ought to address?

Mr. RUCKELSHAUS. The current law is not directed at long-range transports or acid rain kinds of problems. It is directed at health. Where the States have set a standard below where it is necessary to achieve the ambient air quality standard in their existing SIP, and then they come in for an amendment to permit that allowable limit to go up to the ambient standard, we really don't have any recourse but to grant it under existing law.

We have got a number of those pending right now in front of us.

Senator CHAFEE. That is what I am asking you. Is there a loophole in the law that we should address?

Mr. RUCKELSHAUS. It is a loophole if what we are trying to do is hold down the emissions for purposes of controlling long-range transport. It is not a loophole if what we are trying to do is achieve the purposes of the Clean Air Act as currently written.

Senator CHAFEE. I recognize that. What is your answer, though, to changing the focus?

Mr. RUCKELSHAUS. If the committee, if you were to decide that what you would like to do is not see any increase over current levels, then the committee could obviously suggest that be done or they could write it into law that that be done. But under the way we currently are administering the law, we don't see we have any recourse when they come in for an amendment except to grant it.

Senator **Chafee**. I appreciate that. What I am trying to get from you is your thoughts on that, your thoughts on our making some change in the law.

Mr. **Ruckelshaus**. Now we are back to what are we going to do about acid rain and what this committee's action should be in terms of acid rain. That was the purpose of my testimony in chief. Needless to say, it is awkward to have to keep increasing the allowable SO_2 emissions at the same time we are hoping that they stay level while we get a better understanding of what we need to do in the long run.

Senator **Chafee**. It seems to me there are two separate things here. One is trying to deal with reducing the SO_2 emission that currently exists. Another is, and it seems to me the easier part, is permitting an increase in the SO_2 emissions from those that currently exist.

It seems to me that I cannot see any disagreement that the SO_2 emissions are harmful. To what degree, how we should handle it, what we ought to do. That is why we are here today. But I cannot see any argument against hoiding the SO_2 emissions at the current levels rather than permitting them to be increased on the basis that the health standards haven't been abused.

Mr. **Ruckelshaus**. Senator, if the question is am I comfortable allowing emissions to go up while the current debate is going on, the answer is no. I am not comfortable with that. If that were not mandated under the law, if we could maintain the status quo while we try to find out what is going on, it would be better.

I think we have got to be careful about how much we think they are in fact going up as a result of these SIP amendments. But your point is well taken. I am not quarreling with the point.

Senator **Chafee**. Beyond my point being well taken, are you prepared to help us in this? Do you think it is a worthwhile effort for us to try to achieve this as sort of a stopgap measure?

Mr. **Ruckelshaus**. I certainly would be glad to explore with the committee how they would like to go about doing it, and as I have already indicated to you, if it were possible to hold these levels where they are, whether we go forward with a plan or whether we continue to research it, I think we would be better off.

Senator **Chafee**. Sort of related to that is the fact that in some areas that are not violating the clean air standards, they are not doing so because they have these very tall stacks which push the pollutants into the upper atmosphere and transport them downwind.

Is there something happening in the Federal court ordering the EPA to rewrite the regulations affecting the tall stacks?

Mr. **Ruckelshaus**. Yes. There is. Our regulation involving tall stacks, which was a provision written into the 1977 amendment, has been declared not consistent with the law and we have been asked to go back and redo the tall stack regulation. This in effect would tighten it, is what they said, which would have the effect of reducing the SO_2 by some magnitude, certainly nothing like this committee is suggesting in any of the bills that are pending before it. But that is one of the things we are currently working on.

Senator **Chafee**. So that will cause some action to be required on the part of those with the tall stacks?

Mr. **Ruckelshaus**. It involves how much credit you can take against your emission requirement for having tall stacks, and if we have permitted too much credit to be taken, which is in effect what the court said, reducing that down consistent with what the Congress intends. This would have the effect of reducing SO_2 emissions. I don't want to overestimate how much effect that is going to have.

Senator **Chafee**. I have to go to a luncheon. Senator Symms has a statement, which I will put in the record with the other opening statements (see p. 8), and two questions which he would appreciate if you would answer.

Mr. **Ruckelshaus**. I would be glad to.

Senator **Chafee**. We will get those to you.

[Senator Symms' questions and the responses follow:]

Question 1. Do you think that currently available scientific evidence shows that a uniform fifty percent reduction in sulfur dioxide emissions in the Eastern United States would protect the most vulnerable eastern lakes and streams from further acidification?

Answer. It's probable that acidic deposition, changes in the vegetative cover due to man's activities or natural processes, and/or natural soil chemical or biological processes produce varying amounts of excess H+ ions over time. There is currently insufficient information to accurately assess the relative contribution of each of these sources of acidity on acidification of lakes and streams, much less predict future changes which might occur should emission rates increase, decrease, or stay the same.

This issue is of highest priority within the National Acidic Precipitation Assessment research plan.

Question 2. Several recent articles in scientific journals have indicated that much of the acidification of lakes and streams which has taken place may be the result of natural increases in the acidity of soils which in turn are associated with changes in the forestation patterns in the eastern half of the country. Is this hypothesis one which EPA is taking seriously?

Answer. Changes in the "type" of forests, the amount of forest cover, the changing of farms to forests, the increase or decrease in frequency and extent of forest fires, and climatic cycles can all influence the chemistry of surface waters. The National Acid Precipitation Assessment Program is conducting research to identify the influence of each.

Senator **Chafee**. Senator Mitchell, do you have further questions?

Senator **Mitchell**. I have a number of questions, Mr. Chairman.

Senator **Chafee**. That doesn't surprise me.

When you are completed, why don't you adjourn the hearing? I want to thank you, Mr. Ruckelshaus, for coming and we appreciate your testimony here today and, obviously, this isn't the end of this.

Thank you.

Mr. **Ruckelshaus**. Thank you, Senator.

Senator **Mitchell**. Mr. Ruckelshaus, Senator Stafford mentioned the question of the cost of fish in his opening statement.

I have before me an editorial in the Wall Street Journal which quotes David Stockman as having calculated that an acid rain control program advanced by you would cost $6,000 a pound on every fish saved and in the Northeast it goes up to $66,000 a pound.

The editorial accepts those facts as correct and then goes on to make a very lengthy argument against the proposal that you allegedly advanced.

Has there in fact been such a calculation by Mr. Stockman?

Were you made aware of it and could you describe it to us and provide a copy to the committee, please?

Mr. RUCKELSHAUS. The calculations of Mr. Stockman are in his possession. I am sure that he would be glad to provide the committee——

Senator MITCHELL. Have you ever seen them?

Mr. RUCKELSHAUS. No. I have heard the $6,000 fish and $66,000 fish figures being expressed.

Senator MITCHELL. By Mr. Stockman?

Mr. RUCKELSHAUS. Yes.

Senator MITCHELL. Did you ask him what the basis of that calculation was?

Mr. RUCKELSHAUS. He was estimating the amount of damage that has occurred to date that we can document and translating control programs of various kinds into what it would cost to restore the fish in those affected lakes.

I don't believe it was the basis on which the current administration position is founded, Senator.

Senator MITCHELL. No. But while there may be some Americans and apparently the Wall Street Journal also who accept David Stockman's figures, I am not among them. This has been used over and over again. It just seems to me to be one of these things that is kind of catchy and if it is repeated often enough, it becomes accepted as the fact and when you trace it back historically sometimes, you find there is no basis for it.

I am just trying to determine whether in fact there has been such a calculation, the methodology by which it was done and the effects of it, so if it is true, we ought to know it. If it isn't, we ought to rebut it. It has become a part of the debate. I wish you had questioned it a little more carefully. You say you don't have it, I will write to Mr. Stockman and ask him for the study. Maybe we will get it from him.

I would like to make a comment on Canada. There have been several comments made about the Canadians here today and their lack of action. In fairness to the Canadians, is it not true that over a year ago in negotiations between that country and this country they offered to undertake to commit themselves to a 50-percent reduction in sulfur dioxide emissions over 10 years and the United States rejected that offer?

Mr. RUCKELSHAUS. That is exactly what my response to Senator Burdick was.

Senator MITCHELL. I want to ask about something that was already referred to earlier and that is the petitions by other States, although the section was not referred to. It is, as you know, section 126 of the Clean Air Act. It is my understanding that the petitions were first filed by the States of New York and Pennsylvania in December 1980, that in October 1981, the State of Maine filed a petition which was consolidated with the New York and Pennsylvania hearing and that 19 months have elapsed since the statutorily imposed deadline upon the EPA under section 126 for EPA response.

In other words, you have not complied with the law in this respect by responding within the time that the statute mandates. So my question to you is, Why has the EPA failed to respond as required by the law in this respect?

Mr. RUCKELSHAUS. You are right. The 60-day limit has not been achieved, Senator. And the basic reason is because of the complexity of the questions involved. The Agency really doesn't know how to do in a modeling sense, as I mentioned earlier, what the States want us to do.

I do think we have to respond. I have asked the staff to prepare a response. The staff in fact, I think, has been working on a response now for several months. We are going to try to meet this deadline.

If we cannot, we will meet it as quickly as we can.

Senator MITCHELL. Do you feel that the law is inadequate or merely that the subject matter is unable, you are unable to deal with the subject matter within the law?

Mr. RUCKELSHAUS. Where deadlines have been set in these statutes, and they have been set in the Clean Air Act, the Clean Water Act, virtually every statute that we administer, we are often met—that isn't to say we don't miss some deadlines out of mismanagement, or neglect or whatever—but we are often met with the choice of meeting deadlines and coming out with an inadequate decision simply because we haven't done the analysis, or missing the deadline and in effect, as you suggest, at least on the surface violating the congressional mandate.

That was true when I was here 10 years ago. It is still true. It is a draconian choice. I don't like either one of them.

Senator MITCHELL. We look forward to your response. I understand from your earlier comments that you will attempt to comply with the 60-day period in connection with the most recent petition.

Mr. RUCKELSHAUS. We will try. I cannot promise you that we will be able to do it because of the complexities involved. I understand they are going to go ahead and sue. The notice has been given in order to force us to do it. Undoubtedly, we can be forced to do it, because the law mandates that we do it.

Senator MITCHELL. Another section of the law which is section 115 provides, as you know, that whenever you receive the report from the duly constituted international agency that pollution emitted in this country causes or contributes to the air pollution which may endanger health and public welfare in other countries, you shall, not may, shall give formal notification to the Governors and States in which the emissions originate.

Section 115 is now applicable for invoking. In January 1981, the then administrator who received reports of acid rain damage in Canada from United States emission sources determined as the law requires that Canada had given the United States essentially the same rights as provided in section 115 of our act and in fact that was in response to a letter that I wrote and asked to make such a finding.

I am advised that EPA has never notified any State in which the endangering emissions originate which is necessary to trigger the SIP provisions that make section 115 operative. It appears once again that you have failed to comply with the law in an area regarding acid rain, pollution control.

My question to you is, if that is true, why have you so failed and what do you intend to do about that?

Mr. RUCKELSHAUS. That very question was raised in an earlier lawsuit, Senator. The question was whether or not there was Agency action. The suit was dismissed on the grounds that the Agency had not acted because it was necessary to notify the States in order for that action to take place and for the mandate to occur. That was the defense the Agency raised against the lawsuit earlier. The same issue was raised in the petition that has been filed under section 126 by the three States, including your home State and, again, the issue was whether we are mandated after those findings have occurred, and did occur, by Mr. Costle when he was the Administrator, to then inform the States, or whether that is necessary for Agency action actually to occur that would then force the States to go ahead and prepare a State implementation plan.

Our defense in the lawsuit—that was before I arrived—was that there was not the requisite agency action to provide the court underlying jurisdiction to mandate us to act further.

Senator MITCHELL. Is that still your position?

Mr. RUCKELSHAUS. Frankly, I will have to review what has happened. I reviewed section 115 in some detail as I have section 126 in reviewing this whole law. They are very cumbersome ways to deal with this problem.

I understand the frustration of the States involved who are trying to get—in the case of Pennsylvania, Ohio to stop pouring stuff over on them, and in the case of New York, Pennsylvania to stop pouring it over on them.

If we get into section 115 and try to mandate back to the Midwest States what they ought to do to reduce emissions in order to have the desired effect in Canada, we are into, I am afraid, a 10- to 15-year struggle in the courts and otherwise that may or may not end up with any resolution.

I don't believe that is the way we are going to solve the problem of acid rain.

Senator MITCHELL. In my opinion we are not going to solve it the way you think we are going to solve it. I think your recommendations are simply more delay and obstruction by the administration and what you are saying is that you are opposed to any new law, yet you are failing to enforce the existing laws which are very modest in their effect.

Mr. RUCKELSHAUS. With the existing laws, we are in the same box that we are in in trying to decide what to do about any of these interstate problems, namely how do we model back from where the receptor areas are to given requirements for sources in these existing States.

We are right into that same modeling kind of box that is going to make it very difficult for us to prevail in court. In my view if the answer to the acid rain problem is an SO_2 control program, for that to work, it has to come from Congress.

I don't think we can do it under the existing authorities of the Clean Air Act.

Senator MITCHELL. I don't disagree with that. But under existing law, there are certain mandates. You have to comply with existing law. I understand what you said with respect to section 115. I asked if you would continue your review of that matter and report to this committee as soon as possible on what your present intention is with respect to that provision.

Mr. RUCKELSHAUS. Senator, let me just say in section 126, what we have been asked to do is act. On the basis of what I currently know, I don't know how I would do it. I don't know how I would translate back from what is happening in the form of acidity of the rainfall into some sort of requirements on the emitting States.

In my view, the States are going to be in the same box under section 115. So going from where the problem currently is, where Mr. Costle took it, to mandating the States to adopt some kind of SIP's, I don't really know how I am going to do it so that it will provide any progress.

If I don't know how to do it, and the court has already said that is what triggers the whole law to take effect, then I don't see how I am going to proceed much further.

As I say, I am looking at it because of the 60-day notice that has been filed to see if there is anything we can do that will be helpful. I don't want to suggest that I am optimistic that we are going to be successful.

Senator MITCHELL. On another subject on October 21 of last year, you proposed in the Federal Register a major change in sulfur dioxide regulation affecting powerplants built between 1971 and 1978. This affects 124 powerplants.

My first question is wholly apart from the proposed change in regulation, under existing requirements; 124 powerplants would be limited to emissions of approximately 623,000 tons of sulfur-dioxide per year. Notwithstanding those requirements, they are now emitting over 1.5 million tons a year, wholly apart from any proposed change in regulations which in effect liberalizes them, is it correct that you are not enforcing the law in this respect and if so, why not?

Mr. RUCKELSHAUS. That is the interpretation placed on the regulation that we proposed by the Natural Resources Defense Council. We don't believe that by not enforcing that 3-hour standard—on that 3-hour test which is really what it is—we are refusing to enforce existing law.

The purpose of continuous emission monitoring, the 30-day averaging that we are suggesting be put on these plants built after 1971, where the new source performance standards at that time applied—which is, by the way, the same requirement that applies to new source performance standards built after the 1977 amendments of this Congress—was not to allow emissions to increase. It was to provide a way for the agency to enforce the existing standard.

I am in the possession of the objections of the NRDC and others. Our staff is actively discussing with them the basis of their objections. We don't believe that they are correct at this point, but the purpose of this change of a 30-day averaging versus the 3-hour test that we normally use, that we imposed back in 1971 to determine what the emissions were, was to provide an enforceable standard.

We didn't think this 3-hour test gave us a very enforceable standard because of the great variability in low sulfur content coal. We would often get blips, or it was possible to burn a batch of the coal that was lower sulfur and avoid any kind of enforcement action.

Over a 30-day period we get a much better understanding of whether in fact they are violating the new source performance standard. It wasn't the purpose of that regulation to increase emissions. But that was the charge that was made.

Senator MITCHELL. It increases the allowable amount of emissions. What it says in effect is you are required to emit at this level. You are emitting at this level. The change of regulations that you propose will allow you to emit at this level. In effect, it accommodates the existing law to the current level of emissions.

Mr. RUCKELSHAUS. To a certain extent that is right but according to the laws, the compliance coal was qualified as 1.2 pounds per million Btu. In order to achieve the 30-day averaging, they have to burn something like 0.9 pound per million Btu. If you had an enforceable 3-hour standard it could take it down to something like 0.6 pound per million Btu. It was the difference between 0.6 and 0.9—which is where the 700,000 tons came from—that it was suggested that we were ignoring by not enforcing the 3-hour standard.

Our problem is we don't really know how to enforce that 3-hour standard because of the variation in sulfur content of the coal. It is a proposed regulation. We are talking to NRDC to try to better understand what their objections are and what they think is possible in terms of the current law to enforce these regulations and to enforce the 1.2 pounds per million Btu.

One effect of a 3-hour standard could be to force the compliance coal level down to 0.6 About 25 percent of the coal in the country is now at that 1.2 limit, so-called "compliance coal." But if we pushed it down to about 0.6, only about 10 percent of U.S. coal could be burned in those plants without scrubbing. That isn't really what was intended when the regulation was first issued. But that is the effect of the strict application of that 3-hour standard.

Whether that can all be worked out with them or not is what we are currently trying to do. The purpose of the proposal didn't have anything to do with attempting to provide an increase in emissions of 700,000 tons.

Senator MITCHELL. Whatever the purpose, the effect is as I described it. It could be. I am not sure I agree with that yet. I am not sure that what we are going to end up with, if we go back to 3 hours standard is something that we really can't enforce.

I think it is indisputable that that is the effect. We disagree with that obviously. The fourth area that concerns me, Senator Chafee explored it, you sat there and said to Senator Chafee this morning that you agreed that his point was well taken on the proposed SIP provisions, that you feel uncomfortable in approving relaxation of SIP's that result in increases. Notwithstanding that you have not made a proposal to improve the law in that respect, why aren't you here coming forward with a proposed change that will enable you to not feel uncomfortable and not approve these SIP relaxations?

Mr. RUCKELSHAUS. Because my lack of comfort on the basis of the numbers that I currently have has very little to do with the problem of acid rain. If we were to draw a level where we currently are in terms of SO_2 emissions on the basis of these kinds of submissions we wouldn't have very much effect on acid rain.

Senator MITCHELL. The basis, you are using the figure 82,000?

Mr. RUCKELSHAUS. It is actually more than that.

Senator MITCHELL. That is the figure you used.

Mr. RUCKELSHAUS. I know. I took it up. That was for 1981. It was 19,000 for 1982 and 4,000 for 1983.

Senator MITCHELL. You are now at 105,000. Senator Chafee used the figure 1,500,000. There is a wide disparity. Is it not a fact that you are using actual emissions as opposed to allowable emissions under the relaxations which will inevitably and ultimately occur as the dates for compliance are reached under the individual plans?

Mr. RUCKELSHAUS. Most of them are up to the allowable level when the state implementation plan request came in. Then when it comes in, all they are doing is reflecting reality by the amendment. Once they submit an amendment to us we have no choice but to grant it. A lot of these have been pending for several years.

Senator MITCHELL. And precisely the effect which I described earlier is taking place, a plan requires emissions at a certain level, emissions are actually much higher than that. So we come in and we change the law or the plans or the regulations to accommodate the law to the level of emissions? We say that you can't comply with what you are supposed to do? So we change what you are supposed to do to permit you to continue doing what you are doing?

Mr. RUCKELSHAUS. No. That really is a mischaracterization of what is going on.

Senator MITCHELL. I don't mean to mischaracterize anything. If it is, you correct it.

Mr. RUCKELSHAUS. The allowable emissions is the best estimate that the State and we have of what they are permitted to emit and still comply with the national ambient air quality standards. If they have a SIP which puts them below where they need to go to achieve the national ambient air quality standards and they are above the SIP limits, the State can enforce, or we can enforce at the level of the SIP. That is always an available action for us. However, if they come in and ask for an amendment of the SIP to go up to the allowable level, that is in conformance with where they are currently emitting, we have no choice but to grant it.

Under the law, as long as they are within that ambient air quality standard, we have to grant it.

Senator MITCHELL. I don't disagree with that at all. I don't think I mischaracterized it. What I am suggesting is that that places you in the circumstance because the standard you must use to act on these decisions does not deal with the issue we are now concerned, it seems to me that you ought to be coming forward if you are serious about doing something about this problem and suggest some mechanism for doing it. This is a highly complex area. It is very difficult for members of this committee to gain because we deal with literally hundreds of matters. You deal with this full time.

You have a large staff. It seems to me that if you are really concerned about this you will come forward with some suggestion.

Mr. RUCKELSHAUS. Senator, if I were to come forward with this committee and suggest seriously that by solving this problem, by capping this so that there would not be any further State implementation plan amendments from where they currently were to increase the allowable emissions, and suggest that that was an acid rain control program, this committee would not stand for it. Because it isn't.

Senator MITCHELL. I am not suggesting that. But the problem is you are coming here and saying we don't want an acid rain control problem, and in all these other areas which deal with the same substance, sulfur dioxide emissions which cause acid rain, you can't act on this, we can't act on that, that isn't really a solution. I am saying that the overall effect is plainly one of lack of commitment and desire to deal with the problem and more delay. That is the inevitable conclusion that has to be drawn from the broad range of actions capped by the statement here today.

Mr. RUCKELSHAUS. I really take issue with that. I think that I certainly will give you that if you are at the point where you think something should be done and this administration is not there, you are perfectly justified in pushing your point and making it as hard as you want. In the case of how we are currently administering the current law and attempting to comply with what is our current mandate from the Congress, to the extent that our interpretation of that law and our administration of it has some resultant increase in SO_2 emissions has nothing to do with whether I am committed to try to finally deal with the acid rain problem or not. I mean I have asked my staff to give me a list of things we might do under the existing law to have some impact on SO_2 emissions.

None of the things that have been suggested had anything to do when written with controlling acid rain. We could adopt what are in my view tortured interpretations of the act in order to try to achieve that. I really don't want to do that because I don't think that was the reason they were written in there by the Congress. I think if we don't come forward with a suggestion on acid rain and the Congress decides they want to deal with the problem and gives me a mandate, I will carry it out. I don't think I ought to carry out a previous congressional mandate because I believe something else ought to be done about acid rain, even though the law doesn't give me any recommendation to do that.

Senator MITCHELL. Of course that would be true were the law to be as clear as you suggest. That is what your answer was with respect to sections 126 and 115 where the law's mandate is clear, but you said the subject matter is so complex you can't comply with the law. It is a different matter to have a law which mandates something which you don't agree with.

Mr. RUCKELSHAUS. Wait a minute.

Senator MITCHELL. Let me go on to another subject. It is obvious I am not going to persuade you on this or much of anything else I think.

You referred in your comments to, in response to Senator Simpson's questions, about what important element should be in any program. You gave greatest time, attention, and stress to the accommodation of various interests, utility consumers in the Midwest, coal miners in the coal mining regions. I would simply point out to you that lack of action is a manner of accommodating interest as well or lack of accommodation of interest. If you act you may not accommodate as fully as they want in the interests of the utility consumers, but your failure to act, our failure to act as a government as a society and an action to which you are now contributing significantly also fails to accommodate the interest of the people of the Northeast part of the country who are suffering the adverse effects of this. So a decision not to act is a lack of accommodation of certain interests and a very valuable accommodation to other interests just as well.

That is an important point I think that ought to be stressed. It will cost money but the hard fact of the matter is that electric utility rates in the Eastern part of the United States are substantially higher than those in the Midwest in part because of actions similar, not identical to that described by Senator Baucus in Montana and having paid the price of a relatively cleanup if you will, they now suffer the adverse consequences of the failure of others to do so. That is an interest that I think is simply not accommodated and not dealt with by suggesting that there be no action.

On this question, I want to refer to your statement because I think it is important that there not be any misunderstanding. You stated that we must understand that delaying a control strategy decision to gain better information involves the question of whether we are dealing with the emergency or a phenomenon that can be addressed over a longer period of time. You were, of course, referring to the difference in what you characterized as the direct response theory or its alternative but I would point out to you that the word "emergency" suggests dire circumstances which would elicit a prompt and perhaps not fully thought through response. But the legislation that has been proposed here, the bill that this committee passed 15 to 1, 1½ years ago calls for reductions over a 12-year period of time, final compliance if that bill were enacted today would not be required until 1996. There would be a very substantial period of time within which to complete all of the studies that you are talking about and everybody else is talking about. But before the major expenditure of funds occurred.

That is, it is not, I know you didn't mean to suggest that here but I just wanted to make it clear you were referring to the rate at which acidification occurs and whether it occurs rapidly or whether it is relatively stable under the theories mentioned but it is important to point out that this legislation is not in response to an emergency. It is an urgent situation but it is a carefully thought out plan that would take effect over a long period of time and give plenty of time to deal with it. The difficulty is that if we wait 7, 8, 10 more years you know very well what is going to happen. The statement you made earlier will be repeated all over this country, that is, look we got the new source performance standards in effect.

Pretty soon at some point every coal plant now in existence has to be replaced by a new one. So why are we proposing to do this?

Mr. RUCKELSHAUS. I didn't suggest that.

Senator MITCHELL. You didn't suggest that but you know just as well as I do that those ardently opposing this legislation will use that argument and the more time passes before any specific action is taken, the greater burden will be placed on that.

Mr. RUCKELSHAUS. Senator, the difference that I am suggesting in terms of emergency really has to do not so much with the 1996 deadline or 1989 or whenever these standards might come into place. It isn't just a lake survey. It is really a question of at what speed, whatever is happening is taking place. Let's say we can deal with all of these problems you and I were discussing about a minute ago, about averaging and all the rest. If we can show SO_2 levels coming down over time that would deal with the problem, if that is what it is we are trying to do, that is much different than bringing them down now in terms of the cost and potential social disruption.

That seems to me to be self-evident. I understand the concern and you are absolutely right in terms of the perspective of the people in New England. No action is placing a burden on them, an imposition on them that they find intolerable. I understand that is what you think, that is what they think. But in terms of the question of whether we are dealing with something that is relatively immediate or whether it is something that we have more time to deal with, there is a big difference in terms of wise public policy. That is what I meant by emergency.

Senator MITCHELL. But you see, Mr. Ruckelshaus, there is a direct and inherent contradiction in that approach, that theory that you are talking about and your statement that when we get enough information to act we will proceed. If it is, in fact, a situation in which this so-called theory applies and once you reach a stability you can continue to discharge, to deposit acid at a comparable rate, and if it is true that sulfur dioxide emissions are not going to increase over the next 20 years, then of course the argument is conclusive that we ought not ever to do anything.

Mr. RUCKELSHAUS. I don't think so.

Senator MITCHELL. I don't see how you can say on the one hand, if we find we can deal with this over a long period of time because this so-called theory applies, and on the other hand say but when we get enough information we are going to act, the inevitable result of what is being proposed the implication is clear we are not ever going to get a proposal.

Mr. RUCKELSHAUS. I don't think that necessarily follows. Let's assume that what is called the direct effect is true, the rapid effect is what the scientists agree on. It may well be that that is not uniformly the case in all watersheds in the Northeast. It may be there are certain parts of the country where the other theory would make more sense. We are talking about lakes. If in fact the research shows that there are implications for the Northeast, for the soils, there still may come a point at which we will say, well, we now understand enough to know it simply makes sense to bring these levels down or it makes sense to bring them down much more rapidly than we now are. I don't place the whole suggestion as to whether we move forward with an SO_2 control program on that single hypothesis having to do with the lakes. My guess is that, based on these kinds of arguments that I have observed before, the scientists will come out somewhere between.

We can get closer than we now are between those two positions and understanding what is really happening. But I don't think that disproves the idea that it may be advisable for this society over the long term to start bringing these SO_2 levels down. But it makes a big difference as to whether you are talking about doing it like that or doing it like that.

Senator MITCHELL. I want to conclude by saying that I understood you describe the President's position which you have presented and ably defended here today as rational and not irresponsible and that you describe the bill passed by this committee 1½ years ago on the same subject in identical terms, rational and not irresponsible.

Mr. Ruckelshaus, I spent most of my adult life as a trial lawyer and I argued a lot of lousy cases. I spent a while as a judge. I heard lawyers argue a lot of lousy cases and I want to commend you. I think you have done a good job here today in arguing a lousy case. I just think that the evidence is clear. It is overwhelming. It is increasing daily. And I cannot describe to you the degree of disappointment and chagrin that I feel individually and that I know other members of this committee feel individually at the statements you have presented today, the position which I deem not to be rational and certainly not in the best interests of the people of this country.

We had hoped for more. We have delayed now three-fourths of the year waiting for this and I think if ever that old axiom applied that the elephant labored mightily and brought forth a mouse, it applies here today. And I can only say to you that we are going to do the best we can. We wished, we hoped fervently that you would be with us. We find to our disappointment that you are not going to be but we are going to proceed as best we can in this committee and I hope very much that at some point in time you will be able to join with us in this effort.

I don't expect it. I think the administration's position is clear, the position to which you now adhere and I think it is your opposition to action now that makes the possibility of a meaningful control strategy much less likely and you are therefore contributing significantly in my judgment to a continuation of the serious national problem. I think that is especially regretable in view of your record and what we had hoped but notwithstanding that, we will proceed in the committee, hope we can rely on you for constructive technical information. I know we will be able to because I have every confidence that you will continue to provide that.

I wish you were with us but you are not and we will do the best we can without you. You have been very patient to sit here throughout this long interrogation this morning and I in behalf of the other members of the committee thank you for that.

The meeting is adjourned.

[Whereupon, at 12:30 p.m., the meeting was recessed to reconvene at the call of the Chair.]

ACID RAIN, 1984

TUESDAY, FEBRUARY 7, 1984

U.S. Senate,
Committee on Environment and Public Works,
Washington, D.C.

The committee met at 9:30 a.m., in room SD–406, Dirksen Senate Office Building, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senators Stafford, Domenici, Durenberger, Humphrey, Randolph, Bentsen, Burdick, Mitchell, and Baucus.

OPENING STATEMENT OF HON. ROBERT T. STAFFORD, U.S. SENATOR FROM THE STATE OF VERMONT

Senator **Stafford**. The Committee on Environment and Public Works will please come to order.

Once again I welcome you all here and regret that our committee has not been successful in getting a larger hearing room for this hearing on acid rain.

This morning we are scheduled to hear seven witnesses. Our first will be Senator Danforth from Missouri whom I am especially glad to welcome for two reasons: First, the Senator is an able and respected Member of the Senate, second and more importantly he represents a major Midwestern State. Indeed his State of Missouri is virtually by any standard the largest emitter of sulfur dioxide in the United States. That Missouri is a major emitter of sulfur dioxide, however, does not lessen the legitimacy of Senator Danforth's views or those of his colleagues in the Midwest.

Later this morning the committee will be honored to hear from four Governors. Notably absent from this panel will be a representative from the lower Midwest. But this is not because the committee refused to seek out such a Governor. We invited the Governors of Illinois, Ohio, Kentucky, Missouri, and West Virginia. Each declined our invitation. Senator Danforth's appearance therefore will add some needed balance to the hearings. After Senator Danforth the committee will hear from the four Governors—Governors of New Hampshire, Utah, Minnesota, and Montana.

We are particularly honored that the four Governors have been willing to go to the time and trouble of being here with us this morning. Finally we will conclude today's hearing with testimony from two highly regarded and experienced scientists who will discuss the impacts of acid rain and other transported pollutants affecting the health and productivity of forests.

Since our schedule is full I would now call on Senator Danforth unless another member of the committee wishes to make an opening statement.

Senator Mitchell, do you have an opening statement?

Senator **Mitchell**. I accept your "disinvitation" to speak.

Senator **Stafford**. Senator Humphrey.

Senator **Humphrey**. No.

[Opening statements submitted for the record follow:]

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

I would like to welcome here today five such distinguished Governors. Thank you for taking the time to come before our committee to testify about acid rain.

As you know, 18 months ago this committee approved an amendment calling for a reduction of 8 million tons in annual sulfur dioxide emissions in the Eastern United States over a 12-year period. This represents a 36-percent reduction in emissions, and it was adopted by a vote of 15 to 1.

The committee's acid rain amendment recognizes that the sources of the manmade emissions causing acid rain should be the ones to reduce their emissions. There are 31 States in the Eastern United States, producing a total of some 22 million tons of sulfur dioxide annually. Half this total comes from six States: Ohio, Pennsylvania, Indiana, Illinois, Missouri, and Kentucky. The committee's acid rain amendment requires that the largest reductions take place in the States with the greatest emissions.

This approach seems to me to be wholly consistent with the findings of the National Research Council's June 1983 report. We can conclude, from the Council's study, that reductions in sulfur dioxide emissions in the 31-State region of the Eastern United States will yield reductions in sulfur deposition in the same region approximately in a 1-to-1 proportion.

Several of the acid rain bills introduced recently have contained provisions to tax electricity to pay for emission controls. I cannot endorse a scheme that taxes electricity in New York to pay for the installation of pollution control equipment in the Midwest. A tax that falls on electricity alone is inefficient and inequitable.

The average cost of electricity for residential customers in New York is 10.2 cents per kilowatt-hour; it is 6.7 cents per kilowatt-hour in Ohio. Why should the tax be on electricity? Any economist will tell you that you tax something if you want less of it. We want less sulfur dioxide, not less electricity.

I understand the purpose of an electricity tax is to spread the cost of an acid rain control program. May I suggest, however, that we begin instead by designing an acid rain control program that reflects the science as we know it, not the politics I believe that our committee bill does this. Then, I suggest we can go about finding equitable and efficient ways of dealing with those who may be unduly harmed by such a control program.

We welcome your thoughts and suggestions along this line. As governors, you will be responsible for implementing any acid rain program that Congress passes. We value your views and insights and look forward to your cooperation.

OPENING STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Mr. Chairman, today we can get down to the serious business of how to address the problem of acid rain. I think that after Mr. Ruckelshaus's testimony on behalf of the President last week, I am safe in saying we are our own.

This committee is serious about addressing the acid rain problem. Two years ago we developed an approach to the problem which moves in the correct direction to address the problem while at the same time preserving the underlying principles of the Clean Air Act. I am concerned that it does not go far enough in addressing regional inequities.

Whatever we do as a committee, it must be undertaken within the larger context of the Clean Air Act. A control strategy must be fair to all regions of the country and it must be responsive to the problem.

REGIONAL EFFECTS OF THE CLEAN AIR ACT

The effect of the policies set forth in the Clean Air Act do not uniformly affect all regions of the country. The Northeast is bearing a tremendous burden from acid rain.

We must address this problem directly. At the same time, it is imperative that a solution to the northeast problem not exacerbate regional inequities. Both current regional inequities as well as inequities which could be created as part of an acid rain control strategy must be avoided.

BAUCUS CONCERN

I abhor mandatory scrubbers and unfair national taxes to pay for them. I will not accept them. I believe that my colleagues in the West will join me in this resistance.

The 1977 Clean Air Act amendments requiring all coal no matter how low in sulfur content, reduce its sulfur content an additional amount has put a great burden on the entire country. This requirement unfairly excludes low sulfur coal from being considered as a viable clean-up option.

And it has contributed to the acid rain problem in the East. It has inhibited the replacement of outdated, obsolete coal fired powerplants that spill millions of tons of oxides of sulfur and nitrogen into the atmosphere.

Percentage reduction is nothing more than a transparent attempt to protect the high sulfur coal industry. Acid rain is the legacy of this failed policy.

COST OF PROTECTING MONTANA'S AIR

I have talked about the large investment that Montanans have made to protect its air quality on a number of occassions. The Montana Power Co. has recently filed for a rate increase with the Public Service Commission to pay for two new coal-fired generating facilities. If approved, a typical customer in Montana using 750 kilowatt hours per month who now pays $29.90 for that service would see his monthly cost rise to $47.00; 36 percent of this increase can be directly attributed to pollution abatement, in other words scrubbers. We are willingly paying our fair share. We should not be asked to pay for others who do not have the same commitment to clean air that we have.

At the same time, existing policies in the Clean Air Act force areas to pay for scrubbers even if they do not contribute to meeting the objectives of the Clean Air Act. Regional inequities need to be addressed.

GOVERNOR'S TESTIMONY

I look forward to hearing from Governors from throughout the various regions of the country. Their testimony will provide a needed regional perspective on the acid rain debate.

I would like to extend a special welcome to governor Ted Schwinden from Montana, a personal friend and colleague. Montana is a clear leader when it comes to protecting high air quality. I really appreciate Ted coming to this hearing today to present Montana's viewpoint.

Senator STAFFORD. Senator Danforth, we are most pleased that you are here with us. We would be happy to hear your statement.

STATEMENT OF HON. JOHN C. DANFORTH, U.S. SENATOR FROM THE STATE OF MISSOURI

Senator DANFORTH. Mr. Chairman, thank you very much. I do have a prepared statement which I would offer for the record.

Senator STAFFORD. We will place it in the record in its entirety. (See p. 115.)

Senator DANFORTH. Thank you.

Also, I have a text of an amendment which earlier this week I introduced to S. 768 and I would also offer that to the committee for the record.

Senator STAFFORD. Without objection that will be included in the record also. (See p. 122.)

Senator DANFORTH. Mr. Chairman, I happened to have been presiding over the Senate on the day when S. 768 was introduced and I can remember hearing Senator Mitchell speak on the subject. I believed at the time and I still believe that acid rain is a serious problem and that it is a problem which should be fixed. I do not believe that it is sufficient to continue to study acid rain and I do not believe that it is an answer just to put more funds into a study. I think that the time has come for Congress to act. I was an original cosponsor of Senator Mitchell's bill.

I subsequently took my name off the bill because of one simple reason, that is, that while I want to help solve the problem of acid rain the bill as it was drafted and as reported out of this committee operates for the benefit of one region of the country to the detriment of another region of the country. It is just too regional a piece of legislation. Particularly it acts to the detriment of the State of Missouri. All of the benefits from this bill flow to Northeastern States.

Virtually all of the costs are imposed on Midwestern States and I do not believe that that is reasonable. Therefore what I have done in the amendments that I offer to you today and that were offered on the floor on Monday is to present a way to try to solve the problem now, not just to study it further but to try to solve the problem now and to do so in such a manner as does not present an undue burden on the Midwest or on the State of Missouri. And there are two particular ideas that I have in mind with this amendment. The first is to exclude nine of the States that are now covered by the bill. The excluded States would be Iowa, Missouri, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, and South Carolina.

Not necessarily to exclude them forever but to exclude them at least until the 2-year study that is provided in the bill is undertaken and then after that 2-year period of time to allow the Administrator of EPA to include those States if he finds on the basis of the 2-year study that the purposes of the act would be better served by including the additional States.

It is my understanding of the study that is provided in the bill is that it is supposed to analyze the effects of the long range transport of sulfur dioxide and it is certainly true that there is a dispute as to the effect of distance on the transportation of sulfur dioxide. The line that is drawn in the bill in its present form is an arbitrary line. And the question that I raise in this amendment is whether it is the right arbitrary line and I would simply say that before including the nine States which I have named it would be preferable to have the study completed as to the effect of long range transportation. Washington University in St. Louis has a study which shows that after about 600 miles the effect of sulfur dioxide falling on people is de minimus; 600 miles from the State of Missouri gets you to western Pennsylvania. So I doubt whether the coal that is burned in our State is falling on Maine or falling on Vermont.

The second suggestion that is made in the amendment is that the cost of the program be borne not only by the States that are emitting the pollutants but by all of the States in the region; under my proposal, 22 States—and if that is expanded by the Administrator of the EPA, 31 States. Under the bill in its present form in the city of St. Louis utility bills would go up by 20 percent. And they would go up without any benefit whatever to my constituents.

If the costs were spread out throughout the region, the most that bill would go up in any area would be 5 percent which I think is bearable. So, Mr. Chairman, I offer these two suggestions by way of a compromise because I think the time has come to act but I think that action is going to be pretty difficult to come by if the legislation remains as regional in its benefits and its costs, as divisive as the present bill is.

Senator **STAFFORD**. Senator Danforth, we hear you loud and clear. We appreciate your again joining this committee and the fact that you have offered us advice and that you recognize the problem and that there may be optional ways of attacking it other than those that are encompassed in the present working paper in front of this committee which is the bill the the committee produced 2 years ago. I don't have any questions at this time. Any questions from Members? Why don't we start with you, Senator Mitchell, and then we will go to Senator Durenberger.

Senator **MITCHELL**. Thank you very much, Senator, for your statement. The committee members all appreciate your interest. You have taken the time to develop alternative legislation and have come before this committee twice.

I wonder if you would supply for the committee's records, it need not be done now, at your earliest convenience the basis for the estimate that utility bills in the St. Louis area would go up 20 percent, the method by which that estimate is calculated. I would simply point out that I have previously introduced into the record the results of an analysis of electricity rates were the legislation that I originally proposed be enacted. That was a reduction of 10 million tons over 10 years. It was done by the Clean Air Coalition. According to this analysis if the legislation were passed in that form, as originally proposed, and if cost efficient methods of compliance were adopted and the legislation of course does not mandate any specific method of compliance for that very reason, utility rates in Missouri after compliance would average 60.23 mills per kilowatt-hour.

Utility rates in the three Northern New England States, Maine, New Hampshire, Vermont, would average 74.25 mills per kilowatt-hour. I cite these figures only to point out that one cannot only consider prospective utility rates in discussing what to do about this problem, but must also consider current utility rates and the causes for the enormous disparity which exists.

It is quite true as you suggest that the solution proposed by my legislation is regional in terms of benefit and effect. That is of course because the current situation is regional in terms of effect and benefit. The New England States especially and other Eastern States pay very much higher utility rates in part because they have already taken the steps necessary to minimize emissions of sulfur dioxide. And I think it has to be kept in total context. I understand exactly what you are saying. It is a well put position but I think it provides only half of the picture not to discuss the reason why we are in the current situation and of course the current cost that is being exacted, not only in presently high utility rates but also in damage and I think your point on the long range transporter is a very persuasive one. It is a very difficult question which we have not had the answer to with scientific precision. I merely wanted to make that statement to perhaps put the whole matter into total context and to say that we will consider very carefully the legislation you proposed because ultimately you make the most telling point we have got to get a bill passed.

Senator **Danforth**. Thank you, Senator Mitchell.

Of course, any time a bill comes to the floor of the Senate, the question is not what is your view of global matters but what is your view as a Senator of this particular bill and how does this bill affect your constituents? And the bill in its present form is one which markedly would increase electricity bills of my constituents to no benefit at all.

That is why it would be, I think, I would have to fight it as hard as I could. But I would like to do something that is responsible. I mean I think that all of us are part of one country. We cannot have a situation which is injurious, very injurious to a region of the country.

I would like to help New England. I would like to help Canada. I think this is an international problem. But it is important, I think, in fashioning legislation that we do so in a way which is temperate and which takes into account those regions which might be negatively impacted by the bill itself.

It is in that spirit that I have offered two proposals which may help you pass the bill. I don't know. I mean it may be that this is so controversial that no suggestion will end up passing a bill. But I think that this would at least make it easier for some Senators to go along with it.

Senator **Mitchell**. What we have to evaluate is how many votes we lose in order to gain how many other votes because there are a lot of people, some on this committee, who feel very strongly about any cost sharing plan that would exact a cost from their State when they are not contributing either to the problem or receiving any benefit. But I do appreciate certainly the spirit in which you make your proposals. We will consider them.

Thank you, Mr. Chairman.

Senator **Stafford**. Thank you, Senator Mitchell.

Senator Durenberger.

Senator **Durenberger**. Thank you, Mr. Chairman.

Jack, let me start by complimenting you, not only on being into this issue for a number of years, not a Johnny Come Lately to the solution, but also for the statement you just made about the fact that the only solution that we are going to get for the problem, we believe, is the control strategy is going to be a political solution.

The best may not win out in the end. My questions will try to deal with that.

I presume your amendnent has a 3-mill-per-kilowatt-hour tax on electricity production in 22 States. Am I correct in summarizing that?

Senator **Danforth**. Yes.

Senator **Durenberger**. We both along with a lot of other people on this committee sit on the Finance Committee which will eventually pass on that.

One of the reasons an electricity tax or an emissions tax that went across the country bothers me is because of article 1, section 8 of the Constitution which talks about duties and excises being uniform throughout the United States.

I know that together back in 1979 we had an experience with the windfall profits tax which was challenged, the constitutionality was challenged because it was not uniform and was dismissed by the Supreme Court. But there we were as I recall taxing oil differently.

What problems do you see in the situation where you might have one utility in Kansas, one utility in Missouri using the same grade of coal, one has a tax under this, one doesn't? Does that present a problem?

Senator **DANFORTH**. It doesn't to me but I have not researched the law on it. I would be very surprised if there would be a constitutional problem. It doesn't occur to me right off the top of the head but the fact that you have raised it would give me a reason to look into it.

I doubt that it is a problem. I think the question is, where is the harm coming from and how do we effectively get it cleaned up. I think that would be a reasonable basis for the legislation.

Senator **DURENBERGER**. Second, one of the Governors this year will probably testify to the fact that not only is sulfur dioxide from Missouri coming down in western Pennsylvania, coming down in his State as well, and also happens to be in my State but let me say that I came to an emissions tax solution, my version of the solution to this problem, not because the people in my State polled recently preferred that the polluter pay 70 percent over what electricity pays but because I was trying to find sone kind of a marketplace solution to the same problem.

It is 2 percent of the problems of Missouri and how do you let the marketplace rather than some regulator decide whether St. Joe survives or doesn't survive. But you have to come to a different conclusion on a premise I don't quite understand. You put the whole burden for solving this problem at least in the beginning, I think you qualified it, on electric utility consumers but you also in your statement say admit that the consumers really aren't the problem and I would think you would admit that the utilities are not the whole problem either.

They might be half of the problem. Isn't one of the problems we have here that there would be some value in spreading the burden beyond just one-half of the problem in order to bring all of those into the process?

Wouldn't it be easier on Missouri if NO_x coming out of the tailpipes of cars has a tiny weeny bit of a tax on it, or something like that, wouldn't that help Missouri?

Senator **DANFORTH**. I think that the potential for the highest increase in economic effect to people is in their utility bills. And I think that it would fall most heavily in the bill that is before us on the States in the Midwest which burn high sulfur coal in the generation of electricity. So, really, what my interest has been in drafting this is to try to figure out a way so that the people who pay utility bills in my State or other States in the Midwest aren't clobbered by a huge increase in that bill.

I think that that is what the present form of the legislation would do and my guess is that the proposal that you were suggesting would have very similar effect if it was translated into dollars and cents.

Senator **Durenberger**. Thank you.

Senator **Stafford**. Thank you, Senator Durenberger.

Senator, before you leave, let me ask just one question that occurred to me during your answers to other questions.

In your written statement you note that commonsense tells us that particles emitted from the smokestack will fall to the ground, the closer you are to the smokestack the more particles will fall on you. That raises the question to me as to whether or not Missouri may be, to some degree, fouling its own nest as far as sulfur oxide emissions are concerned and that cleaning up the emissions, however the cost might be spread around, or whatever program, would also substantially benefit the State of Missouri as well as those that are down wind from it.

Would you disagree with that?

Senator **Danforth**. Mr. Chairman, in the St. Louis area, I think that most of it would fall on Illinois. But it is my understanding that the damage caused by acid rain is very closely related to what kind of soil and what kind of rock formations exist in the area on which the acid rain is falling. And that if there is a high limestone content of the geological structure of the State, the damage is not severe at all and that that is one of the differences between the Midwest and the East.

I am told, for example, that rain which falls on, say, Indiana and Ohio, where I suppose some Missouri acid rain would fall would not have so bad an effect because of the limestone content. You are going to have to ask that question of people who know much more than I do about the science of acid rain, but I am told that the area greatly affected by acid rain is the Adirondacks and east of the Adirondacks, not west of the Adirondacks.

Senator **Stafford**. Thank you, very much, Senator.

You might want to examine some scientific opinion on the lack of buffering in the southern part of Missouri in connection with acid rain.

Senator **Danforth**. Of course, Mr. Chairman, I am sure there is controversy between experts to be left for further analysis and that after that period of 2 years, the Administrator of the EPA will be the one who makes the decision. So we don't have the case of people who are elected or politicians fighting over what States are in or what States are out. So if there is a dispute as to the effect on certain types of soil of acid rain, maybe that dispute should be ironed out by this study which is built into your legislation.

Senator **Stafford**. We are very grateful to you for coming over, Senator.

Thank you, very much.

I think Senator Randolph might have an observation or a question.

Senator **Randolph**. I do, Mr. Chairman.

I hope it is not improper for me to say that the legislative process can sometimes be painfully slow and then on the other hand, in a matter of minutes, the Congress may act.

I remember when I first offered what became the 26th amendment to our Constitution and I offered that 30 years before it became a reality. I worked during all of that period of time to hopefully bring in that group of 18, 19, and 20 year olds as participants in the process of citizenship by the use of the ballot. And so it is not that I would caution that we act quickly or caution that we act slowly but that we be, insofar as possible, realistic in matters of this kind.

As our chairman would remember, attention to this subject matter was given in the 1950's. It is not something of just yesterday. And our major Clean Air Act was in 1970 when, frankly, for the first time we came to grips with this subject.

I remember that in 1980 we had the Energy Security Act and that specifically authorized research in the subject matter of acid rain. People forget, perhaps, that measure but it was sponsored by Senator Moynihan and came from another committee other than this committee on which he serves. And I do at this time, Mr. Chairman, say for Senator Moynihan who is slightly ill today that he has a statement that he desires to be printed in the record.

Senator **Stafford**. Without objection it will be printed in the hearing at the appropriate place.

Senator **Randolph**. Senator, Missouri is a State that is not thought of as a producer of coal but you produce coal is that right?

Senator **Danforth**. Yes, sir.

Senator **Randolph**. And it is high sulfur coal?

Senator **Danforth**. That is correct.

Senator **Randolph**. Yes, sir. It presents a very real problem to the economy of your State as well as the economy in a State like West Virginia or Kentucky and many other States in which certain types of high and low sulfur coal are mined.

You have given thought to the matter of the costs from the standpoint of electrical power. Have you given, perhaps, some depth of study to the unemployment situation as it would arise for something of this kind that might be dramatic and overnight?

Senator **Danforth**. Yes, I have, Senator Randolph. I think that this is another reason why the approach taken in my proposed amendment commends itself. If the cost of bringing down sulfur dioxide emissions is expressed broadly as I proposed to do there is a much greater chance that the solution to the problem will be to put in scrubbers rather than to shift from high sulfur to low sulfur coal.

I think that it would be a very serious matter to my State and certainly to your State if the expedient of shifting to low sulfur coal becomes the solution to the acid rain problem. But I think under the bill, as it is presently drafted, that would be the case because it would be so expensive for any particular utility to put in its scrubbers that they would have to go the low sulfur coal route. But I think if you spread the cost generally as I intend to do with this amendment, the effect of that would be to make scrubbers economically feasible and, therefore, to hopefully save the coal industry in my State and in your State.

Senator **Randolph**. Just finally, I mentioned the 1970 date for the major Clean Air Act and then there was the 1977 action that had to do with the particular attempt to look into what we call cleanup within industry itself; is that right, Mr. Chairman?

Senator STAFFORD. Yes.

Senator RANDOLPH. So we step by step and often in a very faltering way approach action but I just hope, Mr. Chairman, that you will not feel that some of the—and I know you will not—questions that are asked should in any way delay the vigorous action within this committee in one way or another, either lesser or to greater degree as some members might think because this is a subject that cannot be set aside.

It is a subject that bears hopefully the well reasoned action of the Congress.

Thank you.

Senator STAFFORD. Thank you, very much, Senator Randolph.

The Chair notes that another valuable member of our committee, Senator Baucus is here.

Did you have any opening statement or any questions, Senator?

Senator BAUCUS. I would like to have my statement placed in the record. (See p. 70.) I would like to say that I very much appreciate the testimony of the Senator from Missouri. He has been a very good friend of mine in the years I have known him in the Senate. He is one of the more able Senators that we have had the pleasure of associating with.

That is, in part, because the Senator from Missouri very ably defends his State and his constituents. I might remind the Senator from Missouri that as he well knows, we in the West also have another point of view with respect to this issue here today.

We would like to eliminate some of the provisions in the law which discriminate against low sulfur coal. We have a lot of low sulfur coal in our part of the country. We also are not inclined to favor that emission, national energy or electric taxes that we think discriminate against our part of the country as well. So I might say to the Senator that he is right when he states it is a very regional problem but he is also right when he says it is a national problem.

I know the Senator from Missouri along with other members of this panel will work very aggressively to try to find a national solution. Because we have to share and find a solution to this problem.

Senator STAFFORD. Thank you, very much, Senator Baucus.

Senator Danforth, again, thank you for coming over. We always appreciate your help.

Senator DANFORTH. Thank you, Mr. Chairman.

Senator STAFFORD. Now the committee will be honored to hear from four of our most distinguished governors and they literally cover the length and breadth of the country, Governor Sununu of New Hampshire; Governor Matheson of Utah; Governor Perpich of Minnesota; and Governor Schwinden of Montana.

Governors, if you will come to the witness table, we would appreciate it. It would be the Chair's intent unless you have some agreement of your own that we go in the order in which I listed you and the Chair would invite Senator Humphrey of New Hampshire to introduce to us the first Governor to testify, Governor Sununu.

Senator HUMPHREY. Thank you, Mr. Chairman.

It is my pleasure to welcome our Governors this morning and introduce to you, Mr. Chairman, and my colleagues, Governor of my State of New Hampshire, the Honorable John Sununu.

Governor Sununu is a man, obviously, very concerned about the acid rain problem, comes to us with this concern from a scientific background. He taught engineering at Tufts University in Boston for a great many years. He served as the Chairman of the Task Force on Acid Rain of the National Governor's Council. He is a leader in the New England Governor's Council and has, in fact, come up with his own proposal to deal with acid rain.

We are glad to have you with us, Governor, and welcome.

Senator **Stafford**. Thank you, Senator Humphrey.

Governor Sununu, as a neighbor, I am glad to have a chance to welcome you here too.

STATEMENT OF HON. JOHN. H. SUNUNU, GOVERNOR, STATE OF NEW HAMPSHIRE

Governor **Sununu**. Thank you, very much, Mr. Chairman and members of this committee.

I appreciate this opportunity to appear before you today. Obviously, as a New England State, citizens of New Hampshire do have a very significant concern about the problem of acid rain. In general, there has been a very clear expression of a commitment on their part to support programs which will, in the long run, produce the 50-percent reduction that is the targeted reduction level of most of the discussions and legislation that has been filed.

My testimony today, Mr. Chairman, is based primarily on my own background involvement in matters of energy, matters of the environment. I have had recent experience as chairman of the National Governors Association Task Force on Acid Rain. However, I must stress that I am not here as a representative of NGA since that task force completed its responsibilities and reported the matter to the NGA Executive Committee. We anticipate that the process will allow for consideration of that issue at the NGA meeting which will take place in Washington at the end of this month.

Mr. Chairman, I am sure that everyone here, by virtue of their interest and participation on this committee, is aware of what is happening across the country in terms of trying to address the acid rain situation.

We had in New Hampshire this past month a very significant conference in which representatives from 27 States gathered to address this issue. We were fortunate enough by virtue of timing of our political primary to have an opportunity to hear from some of the principal candidates for President of the United States in 1984 who addressed that conference.

There were three basic resolutions that came out of that gathering. No. 1 was an affirmation of the commitment to a 50-percent reduction; No. 2 is a recognition that there is some internationality to the problem, and I would at a later point like to address some specifics on that issue and; No. 3, which I thought was probably one of the more significant statements that has been made on the acid rain issue was a commitment by all those there that this not become a partisan issue.

You, as Senators, more than anyone understand that the significant issues in this Nation have a tendency to become politicized. The worst thing that could happen is that efforts on the acid rain question be perceived as partisan, be perceived as an issue to divide rather than an issue to unite.

Mr. Chairman, I have with me, and I would like to provide for the record, copies of the resolutions of that meeting for you and your members to have at your disposal.

I would also like to emphasize and extend my appreciation to those in New England who have been addressing this issue. With some deference to the comments that I heard here earlier, one thing that has characterized the debate that has been taking place in New England by its Governors, by its Senators, by those involved in the process, by its representatives in the House of Representatives has been a willingness to address it on a more global sense than the discussions that I heard here this morning.

If we were merely presenting the New England perspective, if we were merely talking about the impacts without concern about the concept of a sharing in both benefits and costs on a national basis, then you would not see the support that the New England Governors and the Northeast Governors have given to specific programs and plans by their votes in the New England Governors' Council and the Coalition of Northeast Governors. I do suggest that rather than address it from the perspective of voting a single constituent of your States, that here is a good opportunity, in terms of establishing a constituency-building approach, rather than a constituency-dividing approach that does exist in the record.

I will provide you, if I may with some of the results of those discussions and some of the background material which I think substantiates the basis for concern.

This is a complicated question. It is a question that has some scientific basis that is required before you draw conclusions as to directions in which to take. It has an economic basis that requires a rational analysis both of benefits and impacts. But I think that there is much more to it than some of the simplifications that have appeared in public discussion. I would like to talk about some of these perspectives that have to be brought in.

First of all, acid rain deals with more than just environmental damage. It is more than an issue of counting fish, it is more of an issue than assessing impacts on the lakes in the Northeast. There is economic damage associated with acid rain that has to be considered in the process. The reality of interregional and interstate competition was the heart of some of the questions and answers earlier this morning. and we recognize that in the process. The problems with most of the legislation that I have seen to date is that it does emphasize differences rather than similarities. I would urge that in the debate that takes place in Washington that there be some recognition of the constituency-building that I think will be necessary if we are to move effectively into an acid rain program that truly does produce reductions and not just political rhetoric.

The acid rain question does deal with jobs, but these are jobs that are not only in the coal industry, but jobs associated with the tourism in New Hampshire, Vermont, Maine, and other areas of the Northeast. Also jobs that are associated with the forest products industry, jobs that are associated with the steel industry, and jobs that are associated with industries that depend on electricity for energy. It is in reality a situation that requires an accounting of jobs, not just in terms of money, but in terms of the breadth of what this Nation has as its economic strength.

I am absolutely convinced that there is a compatability amongst the needs of the region and the needs of the States in terms of economy that can be developed and established within legislation that recognizes in the long run a long-term benefit to all participants in the process. I am absolutely convinced that the division that exists, even within those industries, can be dealt with effectively.

Without a doubt, you know that the coal industry itself is divided into a variety of perspectives, the high-sulfur coal versus the low-sulfur coal, the West versus the Midwest and the Midwest versus the South. I am not convinced that there is not a capacity to provide within legislation a recognition of each of the needs in a way that is constructive. We have heard the debate of science on pollutant transport, and I wish at some other time perhaps to come here, not as a governor, but as one involved in the technologies involved in this area. I would be more than happy to go into a much more technical presentation on the difficulty of trying to assess and evaluate differences in technical opinion. We are dealing here with an issue with subtle differences. We are dealing here with an issue in which the subtle biases of the investors quite often can overcome the subtle differences and results that might clarify a direction which ought to be taken.

I don't think we ought to be surprised that this situation exists. I don't think we ought to attribute to that impact of subtle bias anything negative. It ought to be recognized, but we ought to understand that those of us involved in science and engineering are as human as those of us involved in the political process. The problem of acid rain does deal with fairness and I think that in any legislation that is developed we must go to great efforts to avoid penalizing those who have already made reductions in the past. We must account for that effort and the success of those efforts in any legislation that is developed.

We must avoid in that process a piece of legislation which requires duplication of payment on the part of those that have already made significant payment. And yet, we must understand that there must be some participation in breadth so that this is recognized not as a regional piece of legislation, but as a national piece of legislation. In essence to promote fairness we must give some tax credit for investment expenditures and reductions already made. Let me go back to the issue of the coal industry. I do understand that there are some concerns among States that mine high-sulfur coal. I suggest to you that if you stand back from this issue and take a good hard look at what is going on, not just in the short term, and the intermediate term, but for the long-term use of coal, I think that rather than looking at an acid rain issue as one that may just have a negative impact on that industry, it may be that an acid rain solution is necessary in order to preserve that industry. It will allow this country to utilize its most important energy resource, in the long run, its deposits of both low-sulfur and high-sulfur coal.

I think if we keep those precepts in mind, we will begin to address the solution to acid rain that is constructive. I do believe, first of all, that there is a way to design acid rain legislation that treats all the regions fairly and does not cause ecmnomic disruption or create excessive administrative burdens or costs. The program can rely not just on the legislation itself but on characteristics such as the impacts that markets can have in trans-developments, and I think that in anticipation of that kind of a pressure legislation could be developed.

The commitment to overall goals is significant. But we do feel that there is a reason to build into that legislation interim steps that might allow us to make assessments as we proceed through that process. At the very least, I would suggest to you that a phasing—two-phase and even three phases be part of a process of moving into this that would give us the advantage of moving in quickly to get significant reductions in an early period of time and yet allow us to make, at the very least, a midcourse assessment for what long-term actions ought to be taken in the context of evolving technology.

I do think that the high sulfur coal industry and the low sulfur coal industry will find that by the approach suggested with phasing that they might be able to adjust their differences. Third, I think we have to be concerned about the range of jobs. As I noted earlier, there are jobs associated with industries that are being negatively impacted by the presence of acid rain that have as much of a benefit and should be concerned in legislation.

We have to also understand that some of our export markets must also be part of the process. The capacity of our regions to provide electricity at reasonable costs to their citizens is also of concern. With all due respect to the concerns raised out of the Midwest about the possibility that the rate component in legislation might provide for a nontrivial increase in electric costs, I, as one who comes from a region where 9- and 10-cent electric rates are not unusual suggest that the 4- and 5-cent rates of the Midwest and the 2- and 3-cent rates of the Northwest are so attractive to us that we will be happy to trade places with you on a one-to-one basis.

Fourth, I think we must avoid legislation which freezes in today's technology. Frankly, if all we do is design a peice of legislation that is based on what is available today we will be making a significant mistake by not allowing us to stimulate the improvements which will allow for most cost-effective introduction of technology at the appropriate time. That is another reason I argue very strongly to you for a phase program. Fifth, even though the Governors in the Northeast have tried very hard to address this from a national prospective by our participation in the NGA Task Force, and as Governors recommending a package of solutions which has built into it concessions for those needs of the other regions; concessions where we hope to balance regional perspectives. I must also emphasize that there is a limit to our patience.

We are in the process of trying to develop through our other Governors a consensus position. We look to you at the Senate level in Washington and at the House level to have the ability and the capacity to draw on resources that we sometimes do not have. We hope that you would be able to package the inputs we provide in such a way that we are going to look at a timely solution rather than a solution that gets lost in the debate of the process.

Sixth, I think we have to understand that in suggesting that there is much more to be done in terms of science we may be demanding more of science than it can deliver. Although I do support additional research and development I support it as part of an overall program, not as an exclusive piece of legislation that should be asked to stand by itself as what this Nation will do in the near term. We must begin to build a consensus and a commitment through legislation for reduction of emissions. I would hope that the questions we ask of science as a part of that program not be an alternative to that program.

Finally, I do think that we have enough data to move us in that direction. I, who prior to entering public service made a good living from science and technology, have enough faith in the quality of data that is there to believe that we are at a point where we can constructively move into a program of significant acid rain deposition reduction by reducing the levels of emissions that go out. I do believe the data is there that would allow us to draft legislation that is constructive. I think that we must remember that what we are looking at are significant initial steps that will move us into a long-range program.

I do not think it is unreasonable to look at a program that may have directly and indirectly a total cost measured in $1, $2, or $3 billion a year when we understand that the total utility bills in this country are of the order of $120 to $130 billion a year. We are looking at a net impact measured in a very small percentage increase on the whole in terms of what this Nation contributes in terms of the capital investment alone going into that industry. We are looking at a few percentage points for that number as well.

It is constructive for this Nation to address this problem. It is something that in the long run will provide a benefit not only to the regions that are currently the ones that are perceived as having an impact, but across the country. I made a presentation in California a few weeks ago where the new phrases in California are acid fog and acid smog. I suggest to those of you who think that the damage is isolated to the Northeast that you take a much broader look at the evidence that is available. Having said that, Mr. Chairman, I recognize that you and the Senate know your business better than we as Governors do but I urge you to understand that there is an opportunity I think, a window of opportunity, in the next few months for strong aggressive action. And anything that I, as a Governor from a Northeast State, or the Governor associated with 49 other Governors in this country that I think are willing to move this issue forward, one way or the other, if there is anything I can do, I certain applaud your efforts and would be willing to cooperate.

Thank you very much.

Senator Stafford. Thank you very much, Governor Sununu. It would be the Chair's intention to allow all four of our guest Governors to speak first and then go to questions if that is agreeable to my colleagues. I see it is. So we will go to the next one on the list, Governor Matheson. Since we aren't privileged to have a Senator from your State on this committee I will delegate myself the privilege of introducing you to my colleagues. You probably don't need it. But I can say that I have known you for a number of years in connection with other activities of this committee such as highways.

You have always taken a national and I think very intelligent view of things. So for the committee we are very happy to have you come and counsel with us on this very difficult issue.

STATEMENT OF HON. SCOTT MATHESON, GOVERNOR, STATE OF UTAH

Governor MATHESON. Thank you, Senator. It is a pleasure to have the opportunity to appear before this distinguished committee of the Senate along with my colleagues from three other States.

I do have a prepared statement, Mr. Chairman, which I would like to offer for the record and then just summarize it briefly, if I may.

Senator STAFFORD. That would be spendid. We will put your full statement in the record and all of the Governors who wish it that way as well.

Governor MATHESON. Thank you. Basically I bring the point of view of a Western Governor who has had the responsibility for a number of years of addressing the problems associated with the reauthorization of the Clean Air Act and representing an organization of the Western States. It is the Western Governors' Policy Office and it was made up basically of all of the Western States.

I bring that perspective to the committee today. We took a great interest in the Clean Air Act reauthorization—since 1980, actually—and became concerned about the acid rain component adopting a fairly detailed position on that last summer, in Bismarck, N. Dak.

We have come to the conclusion in our analysis of the acid rain issue that we agree that we have a problem and we all want to clean it up. But the thing that keeps splitting the Governors apart is the fact that we are not really talking about the environmental issue.

The acid rain discussion has become a raging battle over economics. The question of timing, the question of scale and the structure of the program are really basic economic problems. What we—WESTPO—have attempted to do is address the acid rain question from one of an environmental perspective but in doing so we recognize that the fallout is still economic.

There is no way you can get away from regional differences. But we have a five-point proposal which we would like to present to the committee.

First of all, we think that whatever legislation is adopted by the Congress should encourage the most cost-effective method of reducing the acid rain problem. We do not feel it is appropriate to mandate specific technological controls or to prohibit the use of cleaner fuels to achieve the emission reductions.

Some legislative proposal designed to protect high sulfur coal jobs and markets, really will distort economic choices and we think ultimately will increase the cost. That doesn't mean we are insensitive to the concern about unemployment or dislocations.

I happen to come from a coal State myself where we have 22 coal mines. Eleven of them are closed. Seven of the remaining have reduced their production to the point where our coal business is really on its back.

Our consumption and production dropped 35 percent last year. So we advocate legislation which would extend and provide protection for unemployment benefits, job retraining and relocation. Frankly putting the price tag on that versus the price tag on forcing and mandating scrubbers, it seems to me, is an economic question that has to be addressed very carefully in terms of the ultimate legislation.

Second, we believe that the legislation, once adopted, should rely primarily upon the States to carry out the emission reductions. We would hope that the States could then, after the legislation is adopted, determine how best to meet the standard which the Federal legislation decides is in the public interest, including early retirement of sources, energy conservation, coal washing, fuel switching, whatever that method that the State could most effectively and most economically adopt.

Third, we think the legislation should not impose nationwide costs while providing only regional benefits. In other words, the Governors in my part of the country object to cost-sharing schemes which would basically tax Western utilities customers to pay for acid rain controls in other regions of the country.

We have already invested dramatically in clean air in the West; 31 percent of Western coal-fired capacity now has scrubbers compared to 7 percent in the East. Utah's investment, for example, in coal technology is very significant. We are in the process of building two major powerplants at the present time, one, the Intermountain Power Project, burns less than 1 percent sulfur coal and we are removing 90 percent of that sulfur through scrubbers and emission rate will be 0.15 pound of sulfur per million Btu's.

Incidentally, the cost for air quality controls at that plant is $308 million. The second powerplant out in the Uinta Basin, the Bonanza powerplant will remove 94 percent of the sulfur and will end with 0.065 pound of sulfur per million Btu's and we spent $155 million on air pollution control there.

Combined with the two plants Utah Power & Light has built since the scrubber requirements were adopted, we have invested about $1 billion in air quality controls in my State alone.

Utahans have been willing to make that investment to clean up the air in our part of the country but I feel they would object to an additional levy on their electric bills to clean up the air in other States.

So we feel that nationwide cost-sharing schemes have the perverse effect of punishing those who have already invested in clean air and rewarding those who have lagged behind.

Fourth, legislation should recognize regional differences in the size and types of emissions, climate, and topography. Congress, we feel, should not impose additional reductions on the West, based on studies in other regions. Western emissions are really low. The 13 West States produce only 4 percent of the Nation's utility sulfur emissions. Those combined emissions are less than the individual emissions of 10 Midwestern and Southern States. But we are concerned about future problems in the West and would hope the committee would support immediate cooperative studies for long-range transport of pollution in the West.

Fifth, we think the legislation should minimize emissions from new sources by retaining the best available control technology requirements. BACT has worked well in Utah and our determinations are usually more stringent than Federal new source performance standards.

I also have two comments about the proposed legislation. The bill that was adopted by the committee last year, Mr. Chairman, Senate bill 768, is largely consistent with the views that WESTPO adopted and which I have summarized here this morning and I hope that the committee will resist pressures to distort the acid rain control program, by changing the approach in S. 768.

I am here to advise the committee that I certainly want to support S. 768 or S. 769 with the higher emission removal with a couple of amendments.

Specifically, in section 187, there is a little ambiguity about whether fuel switching is available. I am hopeful that fuel switching would simply be added as an addition to section 187. The regional emissions cap in section 183 seems a bit too inflexible. I believe the other provisions, if we were to rely on best available control technology, are preferable to the cap on emissions which have the effect of penalizing growth States and most of the Western States are, of course, in that category.

Third, although it looks like a sleeper, I am not sure it is intended to be a problem, I will be concerned about section 121 dealing with interstate transport that establishes new standards for interstate actions and allows litigation from sister States and the citizens of other States under very, very ambiguous circumstances and I think that the risk of litigation is expanded by the language in that section and would ask that it be examined from the perspective of maintaining some control over the rush to the courthouse which seems to be a poor way to solve the problems associated with acid rain and other interstate pollution problems.

In addition, to those few amendments, I would suggest as Governor Sununu has suggested to you, a phasing of the emission reductions program, believing that we should get started on some immediate reductions.

I think that the research is fine and we should continue that. But it seems to me that we have reached the point in the studies where we need to get about our business and the Western States are not here to do anything but to be as helpful and we would like to see the committee and the Congress proceed with legislation with all due deliberate speed.

Thank you, very much.

Senator STAFFORD. Thank you, very much, Governor Matheson. We certainly appreciate the distance you have traveled and the time and trouble you have gone to to be with us this morning.

The next most able and distinguished Governor is from Minnesota and I think it would be appropriate, therefore, if Senator Durenberger introduced him.

Senator **Durenberger**. Thank you, Mr. Chairman.

Gov. Rudy Perpich is uniquely qualified as an expert Governor here today. He came to office originally in 1976 by accident from being Lieutenant Governor when the Governor thought he could be a Senator.

Then he was spared having to run against me in 1978 when I quit the Republican race for Governor in order to run for the Senate. Then he was lucky enough to be defeated by a Republican Congressman who had to take the brunt of a Republican recession and left the office to him in 1982. In that first short term he was involved with some nationally unique environmental problems, one of them the 440-mile direct current transmission electric powerline that he didn't have anything to do with but that he had to try to translate to a lot of farmers in our State, and also by a State which went out in front of solving not only our State's acid rain problems but problems to our Canadian neighbors when they weren't doing such a great job of cleaning up their own act.

So I recommend not only the Governor and his background and experience but his testimony and the concerns that he articulates on behalf of constituents that we both represent.

Senator **Stafford**. Thank you, very much, Senator.

Governor, we would be pleased to hear from you.

Senator **Domenici**. Governor, could I ask the Chair to recognize me for one moment?

Senator **Stafford**. Certainly.

Senator **Domenici**. I have to preside at another hearing, Mr. Chairman, and apologize but I would like to return before you finish. So, if you will, send someone over before you stop, I would like to ask a few questions.

Thank you, Mr. Chairman.

Senator **Stafford**. We would be very glad to do that. Seeing you come in and you are always as you know, most welcome here, I thought the Budget Committee probably had got its resolution out.

Senator **Domenici**. I will have that shortly. We will fix everything.

Senator **Stafford**. Governor.

STATEMENT OF RUDY PERPICH, GOVERNOR, STATE OF MINNESOTA

Governor **Perpich**. Mr. Chairman, members of the committee, I want to thank you for this opportunity to provide the committee with Minnesota's views and concerns regarding acid rain legislation.

I want to thank Senator Durenberger, of course, for being out in front on this issue and attempt to resolve the problem.

Mr. Chairman, a few months ago the Conservation Issue Foundation recognized Minnesota as making the best effort in the Nation in protection of the environment.

So my comments today not only represent Minnesota's concern about acid rain, but those concerns are also shared by our neighbors in Wisconsin and Michigan.

Our three States have thousands of lakes, miles of streams, vast acres of forest that are very sensitive to acid deposition. We also have an important industry that depend on the long-term health and well-being of these resources. Minnesota has something else in common with Wisconsin and Michigan—regardless of what actions we take to reduce acid rain emissions within our own borders we cannot stop acid rain by ourselves. Acid rain is a national problem requiring a national solution.

Minnesota is very, very sensitive because of our State's glacial and geological history. As glaciers passed back and forth over Minnesota they left thousands of lakes, but the glaciers, through their stamping action, also left very thin soil and exposed bedrock. These have low capacities to neutralize acid rain. We in Minnesota have a data base second to none. As a result of our studies by the Minnesota Pollution Control Agency and the Department of Natural Resources we have learned that about 3½ million acres of forest soils in Minnesota are sensitive or potentially sensitive to acid deposition. That represents about 19 percent of the forested land in Minnesota.

Minnesota is known as a land of 10,000 lakes but we really have more than 12,000 over 10 acres in size. Of those, between 1,500 and 2,500 are sensitive to acid rain. That represents about 25 percent of the lakes in the State that are classified as fishing lakes.

In addition to our concerns about lakes and forests, we also are concerned about our peat lands: 1,200,000 acres of peat lands in Minnesota may be affected by acid rain. Some of these sensitive peat lands represent a unique wilderness of wildlife and vegetation that cannot be found in any other State outside of Alaska.

Altogether we believe that about 15 percent of our almost 8 million acres of Minnesota's forests, peat lands, and watersheds are sensitive to acid rain. These areas cover areas of eastern and northeastern Minnesota. These include Voyaguers National Park, the Superior National Forest, the 1-million-acre Boundary Waters Canoe Area Wilderness and even include some park and forested areas in the Twin Cities of Minnesota.

Minnesota's three largest industries are agriculture, tourism, and forestry. Two of these industries, tourism and forestry, are seriously threatened by acid rain. Agriculture is not currently threatened but it could be affected if rainfall becomes more acidic in the future. So the long-term vitality of our forestry industry is threatened by the slow degradation of forest soils.

Senator Durenberger mentioned that when I was Governor in 1978, I left involuntarily at that time and spent 3½ years in Europe representing a Minnesota multinational. At that time I really saw firsthand what happens in many areas of Europe. They just don't have the environmental concerns we have here in the United States. In one country alone I saw about 30 kilometers of forestland completely destroyed. It was in Italy where they had powerplants burning high sulfur coal. So I have seen firsthand and of course you have read what is happening about the forests in Germany.

As far as tourism is concerned, one study shows that the first signs of acid in the lakes in the Boundary Waters Canoe Area will result in the substantial loss of revenues, jobs, and of course destruction of a very beautiful area. So we are very proud of our beautiful environment in Minnesota, our lakes, forests, Voyaguers National Park, and the Boundary Waters Canoe Area Wilderness.

Acid rain is an economic, environmental, and emotional issue in our State. Rainfall in Minnesota ranges from well buffered rain in western Minnesota to highly acidic rain in the extreme northeastern part of the State. This pH in the latter is measured in the low 4 category. Unfortunately the rain is most acidic in the areas that are most sensitive in Minnesota. So far there are no dead lakes in Minnesota but based on Scandinavian experience the acid rain problem in northeastern Minnesota is great enough to have already begun to cause subtle changes in our most sensitive resources.

The MPCA's computer model shows that 20 to 30 percent of the acid rain falling in Minnesota comes from sources within the State. Another 20 percent comes from sources in Canada but the remaining 50 percent comes from other States. The other States contribute to acid rain in Minnesota include our neighbors to the west, east and south, North Dakota, Wisconsin, Missouri, western Illinois, Canada are likely the largest out-of-State contributors. I exclude South Dakota because of a special situation we have with South Dakota.

Minnesotans realize that our own emissions contribute to acid rain in our State. But responsible action by the utility industry has resulted in a significant reduction in sulfur dioxide emissions.

Senator STAFFORD. Governor, if I could interrupt, I didn't intend to do this, but something you said triggered a thought of mine and that is does International Paper Co. have some forest lands in Minnesota?

Governor PERPICH. I don't think so.

Senator STAFFORD. I was going to say, if they do, one of their vice presidents could probably come and explain to you that any damage you are suffering is not the result of acid rain but due to drought in your State. That is the explanation he has given some of the New England States.

Governor PERPICH. I am sorry. I didn't hear.

Senator STAFFORD. The I.P. vice president has explained that damage to forest lands is not the result of acid rain in some of the New England States but a result of lack of rainfall.

Governor PERPICH. Since 1974 we have reduced sulfur dioxide emissions by over 30 percent in Minnesota. We are at a point where major powerplants, industrial sources emit at a statewide average of 1.5 pounds of sulfur dioxide per million Btu. We intend to reduce those emissions even further. In 1982 the State legislature passed a bill known as Minnesota Acid Rain Deposition Control Act. This bill establishes Minnesota as the first State to begin regulating acid rain. As a result we have developed a complete inventory of sensitive resources. We are now in the process of developing a formalized deposition standard to protect those resources. By January 1, 1986, we will have developed a control plan to meet the standard and our sources must be in compliance by 1990.

We already have begun reducing emissions in Minnesota. At the Minnesota Pollution Control Agency's request Northern States Power Co. has agreed to reduce emissions at three of its powerplants to offset emission growth likely to result from operation of a new coal-fired plant now under construction. Governor Sununu may comment about the conference that was held in New Hampshire. At that conference U.S. Power received a special recognition for their effort to reduce sulfur dioxide emission. This action demonstrates how we can reduce emissions and at the same time accommodate future growth.

As far as Federal action is concerned, Minnesotans are frustrated by slow action in Congress and the Federal Government. Naturally we want Federal legislation to insure adequate protection for Minnesota's sensitive resources. The sources that contribute to our acid rain problem differ from sources of problems in other parts of the Nation. As a member of the National Governors' Association and as Chairman of the Midwestern Governors Conference I have been working to develop an acid-rain policy that does not divide our States. This has not been an easy task. Many areas of the country such as the Midwest feel that acid rain legislation will mean only costs for them. Benefits they feel will be realized only in remote areas in New England or in Minnesota.

We all must remember that the lakes and forests we seek to protect are a national resource as well as a local resource. We must not forget the other benefits that will result in reducing acid-rain forming emissions. Those are cleaner, healthier air, more productive crops, reduce material corrosion, and increase visibility. When we balance the cost of control against the value of all the benefits our generation and future generations will find that controlling acid rain now is both environmentally and economically the sensible thing to do.

Now I would like to offer my views on what specific goals should be accomplished by comprehensive national legislation. First, acid rain is a national problem affecting every State. Every State should have protection and every State source should be considered for control.

Second, to adequately protect sensitive resources in the United States and Canada, a 50-percent reduction in sulfur dioxide emissions is warranted. This represents a reduction of 10 to 12 million tons per year in the United States. Emission reductions can be allocated in a number of ways. The method of allocation should take into consideration existing emission levels and emission rates. As does the formula in S. 768, that formally credits States that are already employing emission controls.

Third, to address acid rain on the west coast the committee may wish to consider nitrogen oxide emission reductions. Such reductions can be accomplished through new emission standards on powerplants and trucks.

Fourth, new emission sources, increased emissions from existing sources must be offset from continued protection from acid rain. We need to insure that the 50-percent reduction is not eroded in the future.

Fifth, there must be stronger language in the Clean Air Act relating to transport of pollutants. The current interstate transport provisions do not recognize acid rain as a form of pollution. Sections 110 and 126 must be strengthened to insure that one State is prevented from emitting air pollution that can endanger public health or welfare in another State. The interstate provisions of S.

768 address this issue very well. Finally, I would like to comment on the concept of assisting in lessening the cost of complying with the Control Act. Current Federal legislation controlling air and water pollution revolve around the concept that the polluter should bear the cost of pollution control.

Ideally, that concept should work for acid rain as well. Therefore, we prefer no funding mechanism for acid rain control. However, we recognize the need for developing legislation that is politically acceptable to the Congress. Our goal is to mitigate the effects of acid rain in a timely manner. A funding mechanism indeed may be necessary to meet that goal. In my experience with the National Governors Association, it has made me aware that many regions of the country feel strongly about the need for a funding mechanism.

Some kind of funding mechanism is needed. We prefer one that recognizes to some extent the existing degree of pollution control in a State. However, the most important issue to Minnesotans is reducing acid rain. Therefore, we support whatever reasonable type of funding is required to move legislation through Congress. In other words we are willing to pay. The benefits of controlling acid rain will more than offset the cost of funding the reduction of sulfur dioxide emissions. We believe strongly acid rain legislation must be passed by Congress this year.

Minnesotans support and appreciate your efforts to try to solve this critical environmental problem.

Thank you again for the opportunity to discuss this important issue, and with me today, Senator, is Sandra Gardebring, executive director of the Minnesota Pollution Control Agency and together we would be happy to answer any questions you may have.

Senator STAFFORD. Thank you very much, Governor.

Since the final member of this distinguished panel is the Governor of Montana, we would be very pleased to have Senator Baucus introduce Governor Schwinden.

Senator BAUCUS. Thank you, Mr. Chairman.

Mr. Chairman, as you may know, Montana is the Big Sky State. We are very proud of our open space, our clean air, and I see the Governor from Utah, Governor Matheson, nodding somewhat in agreement. Utah is a big State with open spaces. We, in Montana, are very proud of the fact that we are the Big Sky State. We are also very proud to have as our Governor, Governor Schwinden, who I can say is a very big Governor. He is probably one of the most popular Governors that Montana has had in recent history. He began his education in eastern rural Montana, just north of Wolf Point, Mont. He is a very successful grain farmer and rancher to the degree that one can be successful in agriculture these days.

He also is very active in State politics, State legislature, director of the department of State lands, Lieutenant Governor, Governor, and I must conclude by saying that he is a very good friend of mine, too. We work very well together. We are very proud in Montana to have him as our Governor.

Senator STAFFORD. Thank you very much, Senator Baucus.

Governor, we are delighted to hear from you.

STATEMENT OF HON. TED SCHWINDEN, GOVERNOR, STATE OF MONTANA

Governor **Schwinden**. Mr. Chairman, thank you, Senator Baucus, members of the committee.

I first want to thank you and the committee for your generosity in the time that you have permitted myself and my colleagues to testify on what clearly is one of the most pressing environmental challenges that this country faces. As the cleanup Governor this morning I will try to summarize within the next 10 or 15 minutes our feelings and ask that my written testimony be placed in the record as you have indicated previously.

Senator **Stafford**. It will be done.

Governor **Schwinden**. I am the chairman of the Western Governors Conference. I do not carry a formal mandate from that organization to present a regional viewpoint although along with Governor Matheson I think clearly our views do reflect the attitudes of not only the States of Montana and Utah, but of our other neighbors in the West. It is safe to say that the Western States have generally demonstrated a level of commitment to environmental cleanup at the State level which had it been matched nationwide would have made the current testimony and the Federal acid rain legislation that is presently before the Congress unnecessary.

In Montana we not only enjoy the environmental benefits of using at a growing rate our abundant supplies of low sulfur coal. We also mandate our coal-generated powerplants to install scrubbers further to clean their emissions; and that costs money, too. Our own State of Montana has made a substantial financial commitment to clean air. We in effect put our money where our mouth is. The requirements of clean air technology in Montana in terms of capital construction just over the last half dozen years have amounted to 35 percent of the total capital cost for the construction of the two newest coal-fired plants, the second of which is nearing completion.

The environmental costs borne by the consumers of our State represent 30 percent of the current average retail price of residential electricity in Montana. We do understand the importance of environmental cleanup. We also have an appreciation for its costs.

In our judgment, Mr. Chairman, the committee should adopt acid rain legislation similar to that which it endorsed in 1982, legislation that we felt effectively struck a balance among the conflicting equities surrounding this issue. Two years ago you endorsed an acid rain control program that was both forward looking and politically courageous. It met the key test of substantial environmental benefit at least possible cost and most importantly as Governor Matheson has stressed it left to the States and to the free market the task of balancing conflicting regional and economic interests.

A reaffirmation of that decision of 1982, in 1984 would serve this Nation well. Governor Sununu emphasized the point which I think is important to remember, the existing compatability that does exist within the regions on the issue of acid rain. I think it is easy to forget that with some exceptions there is much more that unites this Nation than divides us on the issue and while certainly there are scientific uncertainties, I think the broad outlines are very clear. Substantial regional reductions in sulfur dioxide should begin and just as soon as possible.

Damage has already been measured and more is being discovered all the time.

The map of sensitive areas Governor Perpich has indicated grows larger as our knowledge increases. Current efforts to quantify the extent of damage suggest that every year we delay is also very costly.

Clearly public awareness and concern are increasing in this country. Sulfur dioxide has been identified as the main culprit, although in sone areas, nitrogen oxides also play a part.

Finally, the principal options for reducing sulfur dioxide emissions are well known. They range from switching to lower sulfur coal, to coal washing techniques and pollution control hardware.

You will hear, I am sure, in the course of your hearings a lot of arguments about some of those points. But I would still hope that most of us can agree on at least the basics of acid rain control.

So what is it, then, that divides us? There is some legitimate debate over the level of sulfur dioxide reduction that is necessary if we are to accomplish the goal of environmental protection. Ultimately the committee must and will, I am sure, make a decision based on its own judgment of the scientific and environmental evidence.

The tough area of disagreement relates to the fact that every acid rain control program designed so fat raises the fundamental questions of fairness among the regions and among the very wide range of interest groups that are involved. Those divisions, I submit, are so complex and varied that no acid rain program can possibly accommodate all of them adequately and still remain politically feasible.

I think Senator Durenberger in his dialog with Senator Danforth today indicated that that is the problem of the political solution. I think rather than forcing a stalemate on acid rain, the recognition of that problem, that knowledge should actually free us to respond more quickly by allowing us to concentrate on the problem itself, the bottom line.

As Governor Matheson pointed out, what we are really involved in is the correction of the existing and potential environmental damage that is caused by acid rain in this country.

In other words, we ought to concentrate on the needs of the environment and recognize that no Federal program no matter how skillfully drafted or constructed can possibly satisfy everyone.

The Federal Government should mandate substantial regional reductions in sulfur dioxide pollution and the Federal Government should leave to the States and the private economy the job of sorting out the equities of that reduction.

State legislatures that wish to adopt market protection legislation for high-sulfur coal may do so. Those States that wish to grant their electricity consumers the benefits of pollution control at lowest cost through low-sulfur coal may do so as well.

The free market is capable of sorting out the equities much more efficiently than any Federal program no matter how expertly designed or well intentioned. A surplus of low-sulfur coal does exist today and new supplies can be delivered quickly.

Transportation costs, price and quality differences will dictate the choice of the best control options more effectively and more cheaply than any mandatory program. Best of all, new technologies that will assure long-term stability in high-sulfur coal areas will be encouraged and they will come on even faster with Federal encouragement. That fundamentally is the approach you chose, I think wisely, in 1982. The well meaning proposals to address the perceived or real economic disruptions only make the real disruptions worse and not better.

As has already been discussed, the major alternatives would require installation of scrubber technology and provide a subsidy of some type or another for installation costs or they would simply offer the subsidy and assume the financial incentive would be powerful enough to prompt the installation of scrubbers.

The alternative proposals would pay for the subsidy program by setting up a trust fund financed by a tax on the consumption of electricity, either in the 31-State acid rain mitigation region or in the Lower 48. That approach would add billions of dollars to the cost of acid rain control. It would put new burdens on consumers, business and industry while producing no comparable environmental benefit. Worst of all, a major subsidy for the most polluting industries would reward them for their earlier failure to comply with the Clean Air Act. More than that, it would penalize the responsible action taken in States like Montana where scrubbers are already required and in other States like Minnesota that have been leaders in cleaning up the air pollution.

Requiring scrubber technology adds $15 billion to $20 billion to control costs with no demonstrable environmental benefit.

It would freeze in the technology that is expensive to install and operate and freeze out both low-sulfur coal and new technology now in the development stage. A national consumption tax requires consumers in my State—who have already financed at substantial cost their own pollution control hardware—to pay for controls in other States that have ignored their responsibilities in the past.

One alternative is before the other house of the Congress in the form of H.R. 3400.

All of the 17 Western States under that legislation would pay more in acid rain taxes than four of the New England States represented here today by Governor Sununu.

With the percentage increase on the average utility bill that imbalance is even more striking. Montana's utility bill would increase more in percentage terms than many of the major contributors to acid rain, including Pennsylvania, Missouri, Illinois, and West Virginia, all among the top 10 sulfur dioxide polluters.

In summary, that kind of legislation would be the worst of both worlds for my State of Montana. Our low sulfur coal would be effectively excluded from the Midwestern and Eastern markets and our taxpayers would be asked to absorb major new electric costs to benefit States that have not acted with the same sense of environmental responsibility as the State of Montana.

In this context, it is important to remember the Federal policy already excludes low-sulfur coal from markets through the percentage reduction requirement which in effect requires scrubbers on new powerplants.

In the process, it tilts the choice of cleanup options away from low-sulfur coal. Percentage reduction is discriminatory and unfair and the mistake made in adopting should not be compounded in the pending legislation on acid rain.

Mandatory scrubbers and trust fund schemes are justified by their sponsors as necessary to prevent job shifts in the high-sulfur coalfields. Those mining areas are suffering hard times and the Congress should certainly address that plight. But that problem exists today. It ought to be addressed today.

In my opinion, it offers false hope to promote acid rain control programs and would be phased in over the next decade as an adequate response to their problems today.

Clearly, any major Federal program will have an economic impact. For its size, acid rain control would have surprisingly little net impact. According to recent analyses, in most areas, the impact would be positive as new job opportunities arise to replace jobs lost.

We ought to be concerned about the job losses but that compassion ought not to lead us to the creation of a multi-billion dollar distortion of an important environmental program of the Clean Air Act, not when the cleanup can be accomplished quickly and cheaply and certainly through reliance on economic choice.

The committee's assignment is challenging indeed to come up with an approach to acid rain control that yields the greatest real environmental benefit and the fastest, fairest, and least disruptive way.

I urge with the other Governors that the committee reaffirm its environmental and social commitment by adopting an acid rain control program roughly comparable to the 1982 bill which was a fair and realistic way to balance the regional equities in our free society.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you, very much, Governor.

Due to time constraints which may affect our guests on the panel as well as the committee in the pending session of the Senate, I would suggest to my colleagues that we limit ourselves to 5 minutes each on the first round of questions.

Governor.

Governor PERPICH. Mr. Chairman, with your permission, I would like to be excused. I have a 1:15 meeting with the Congressman from Minnesota on the closing of the steel facility.

Sandra Gardebring, director, Minnesota Pollution Control Agency will be here to answer questions.

Senator STAFFORD. You certainly may.

We, again, want to tell you how much we appreciate your coming here and presenting your State and your region's viewpoint to this committee.

Governor PERPICH. Thank you, very much, Mr. Chairman.

Senator STAFFORD. Are any of the other Governors in a position where you need to leave? If not, we will go ahead.

We will limit ourselves to 5 minutes for questions. Generally you have expressed support for S. 768 which would cut emissions as you all know by 8 million tons per annum at the conclusion of the program.

Would you also support S. 769 which is generally similar but calls for reduction of 12 million tons of sulfur oxide rather than 8.

Would any of you have a comment on that?

Governor **Sununu**. Senator, I think the commitment toward significant reductions and the debate as to whether it ought to be 8, 10 or 12 pails in terms of its capacity to get legislation passed, pails in terms of its concerns on the other side in terms of distribution of costs.

I certainly feel that the Governors in New England, I think, that is about as far as I can extend my answer in terms of geography, are certainly commited to an eventual 50-percent reduction probably close to the 12-million ton level but we are also much concerned about the other provisions.

I think we would be willing to yield a bit if equitable compensation for regional differences were included in other areas.

Senator **Stafford**. Any further comment? If not, some persons have criticized S. 768 and the other major acid rain control proposals because they are regional in nature; that is, they identify a 31-State region composed of polluters on the one hand and the victims of pollution on the other.

Would any of you support an acid rain control bill which was based on a full 50-State program?

Ms. **Gardebring**. Senator, I am Sandra Gardebring, director of the Minnesota Pollution Control Agency.

If I might speak on behalf of Governor Perpich, as he testified, our evidence from the problem of Minnesota suggests that a fair amount of our problem is coming to us from the West and perhaps North Dakota and perhaps from South Dakota.

We would be supportive and are pursuing through our efforts with the Governor's Association a program which does extend to the 48-State region at least.

Senator **Stafford**. Thank you.

Let me ask any of you who care to comment on this question.

In your particular States and regions, would your constituents support a program for acid rain reduction which was based upon an increase in electricity rates of 3 or 4 percent in your State or region?

Governor **Matheson**. Mr. Chairman, I suspect all of us are familiar with what is happening before our utility commissions throughout the country with respect to increases in electricity rates. In Utah, we have a $100 million rate increase proposal that was filed just last week by our major utility.

We are approaching the point where home utility costs will equal the monthly rent. Utility costs in Utah are a major problem and the studies we have done in our Department of Social Services indicates that utility costs are seriously affecting families at or near the poverty level.

In some cases, utility costs are forcing the people into the poverty class. So a 3-percent increase in my State, to finance acid rain controls would be viewed as a very harsh penalty, particularly on top of the investment in air quality which we've already made.

I pointed out earlier that we are spending $1 billion now with scrubbers on all of the new plants and it seems to me that we would run into some serious difficulty.

I suspect that people would be much more willing to pay a fee or a tax to take care of the problem of an unemployed miner rather than to build scrubbers on everything.

Senator STAFFORD. Thank you, Governor.

Is there dissent?

Governor SCHWINDEN. I believe it was the day before yesterday that a major utility in our State asked for a 47-percent increase, primarily predicated on the cost of the plants which I included in my testimony and with the full awareness that a major portion of those costs are already associated with scrubber technology and clean air.

We have one plant which actually is adjacent to a class 1 air quality area and so the 3 percent is perhaps not as significant as the symbolic fact that they would be asked to pay one more time for the problem which has already cost them significantly in our State because of the pollution control.

Senator STAFFORD. Any further comment?

Governor SUNUNU. Senator, I want to add what I think the principal criteria would be, whether or not appropriate consideration was given to the previous investment and obviously in New England we are looking at an area where the electric rates have grown by 350 percent since 1973, if you guarantee they would only grow 3 percent or no more gain, that would get unanimous consent.

Senator STAFFORD. Thank you, Governor.

Might I assume that the coal powerplants in Montana and in Utah are now in the megawatt range?

Governor MATHESON. One is 1,500 megawatts, two are 440 and one is 1,200.

Governor SCHWINDEN. The four plants in question over the last 6 years are two 350's and two 700's, one of which went on line in October of last year, one which hopefully will go on line later this year.

Senator STAFFORD. Thank you, very much, Governors.

We really appreciate your being here.

Senator Randolph.

Senator RANDOLPH. Miss Gardebring you are the director of the Minnesota Pollution Control Agency, and I noticed when you spoke that our colleague from North Dakota took particular notice as to what you were saying, so I wondered if I might yield to Senator Burdick at this time.

Senator BURDICK. Governor Schwinden, I wonder if you realize that we shouldn't be friends. I come from Williston, you come from Wolf Point.

Governor SCHWINDEN. You have been there?

Senator BURDICK. Yes. You broke my arm in a football game.

Governor SCHWINDEN. You have a long memory.

Senator BURDICK. But I will consider your testimony.

Senator STAFFORD. Senator Burdick, it is your time if you would like to go ahead.

Senator **Burdick**. I have another question for the lady from Minnesota. You say there is some pollution coming from North and South Dakota into your State.

Are you aware that with the exception of two plants, plants are now burning low sulfur fuel all capped with scrubbers in North Dakota at a considerable expense to the people?

Are you aware that north of the border of your State there is the country called Canada that hasn't got a scrubber on a single plant? Are you aware of that?

Ms. **Gardebring**. Mr. Chairman, Senator Burdick, I am aware of it. I am aware of it. I have taken up the Canadian issue with my colleagues in Ontario on a regular basis. You were perhaps mentioning the plant which has been a very real concern to us because of its proximity to our most sensitive area the boundary waters.

I am certainly aware of the issues in North Dakota. I grew up in North Dakota. I had a chance on my first opportunity to vote after I was 20 years old to vote for you many years ago.

Senator **Mitchell**. That lends credence to the rest of her statement.

Senator **Burdick**. Mr. Chairman, I think she has given excellent testimony. That is all.

Senator **Stafford**. The Chair will go next to Senator Durenberger.

Senator **Durenberger**. First a little preface with another hat on. I think the message is really clear, acid rain is a potentially devisive regional issue. The pollution comes from one place and the damage is done in another and the benefit of cleanup accrues to one region and the cost is borne in another and the polluter's and the payer's payment is less than in their approach to the problem.

I just want to say to the Governors here that I have always felt that not only with regard to this issue but others that the Governors are probably in a better position to deal with difficult regional questions today than our Congressmen or Senators. Governors have a whole lot more access to their citizens, to our mutual constituents and if a Governor were to speak for the good of the country rather than parochial interests of his or her State I think it would get an awful lot of attention.

So I think the fact that all of us qualify our parochial interests with our global concerns is terribly important to this whole process.

There are three basic approaches on the table for the control program. One is the Mitchell-Stafford approach that you have been asked about which allocates reduction among States and doesn't provide any national assistance to handle the problem. Second is the electricity tax which we have all talked about in one way or another, third is a little approach that I put together called the emissions tax. It would be imposed on the whole country. The numbers indicate that in about 40 States the emissions tax is somewhere between electricity tax and the Mitchell-Stafford bill. It is not as cheap as Mitchell-Stafford out West but it is a whole lot cheaper than electricity tax. It doesn't provide as much spread for the Midwest as an electricity tax but it does provide some particularly when it is imposed on everybody, not just on electric utilities.

So I am wondering if there is anybody at the table now that would like to get the ball rolling by endorsing an emissions tax?

Governor **Sununu**. Senator, I think that we have as Governors looked at a variety of these and in an effort to try to promote regional support are willing to suggest that there may be a combination of the two as an appropriate, that a portion of the funds be raised by an emission tax, that a portion of the funds be raised by a general electricity tax and somewhere in there is a level of compromise that addresses the concerns that we do have.

We leave it to the wisdom that might reside down here to discover the appropriate fraction therein.

Governor **Matheson**. Just a comment, Senator, your remarks about the Governors maybe having the capability to get an acid rain position together is an opportunity that we will have later on this month at the National Governors' Association winter meeting, and so far, Governors have submitted five different acid rain proposals to the NGA Executive Committee. I am not sure if the Durenberger approach has been represented there, Senator, I am sorry to tell you.

Senator **Durenberger**. I am giving you your chance.

Governor **Matheson**. But in any event it is my judgment that there will be an effort made to develop a coalition approach and trying to get an acid rain position. I think the Governors should stand for the solution to the problem. We are going to discuss it later on after our testimony to see if we can't develop some kind of a coalition approach and we will certainly take a look at the emissions tax. In my State it is not a serious problem. But in some Western States the problem is very, very serious.

Arizona, I guess, would really have an unbelievably difficult time with the emissions tax because of their unique situation. We have to look at the equity issue there as well. Certainly we will take that into consideration. I, for one, will try to go for that coalition.

Governor **Schwinden**. That seems fair, Senator. I think the simplistic way to look at the three alternatives is if Montana were to consider the Stafford approach as good health and the national electricity tax as a heart attack, you have offered kind of a chronic ulcer and I guess it is a preferable alternative at least to the electricity tax.

Senator **Durenberger**. Am I out of time? Thank you.

Senator **Stafford**. Thank you very much, Senator.

I realize many more questions could be asked. But in view of the time constraints I think we do have to stay with the 5 minutes.

Senator Mitchell.

Senator **Mitchell**. Thank you, Mr. Chairman.

I want to again thank the Governors and commend them for their willingness to come here today. I do regret that no Governors from the Midwestern States, the principal emitting States were able to accept the committee's invitation to appear today. I think that would have given us a more broad perspective on the issue.

I think it is important to keep in mind two principal questions. The first is what do we do, that is how and to what extent do we reduce sulfur dioxide emissions? The second question is how do we pay for that? The questioning has focused on the second point. I understand the Governors' comments principally to focus on the first point. They largely endorse the concept set forth in the bill that I introduced and modification that the committee approved last year of establishing by legislation an amount of reduction and then leaving it to the States, the industries, and the free market to most effectively determine how best that can be done as opposed to the concepts set forth in the House bill which is now frequently mentioned, H.R. 3400, the Waxman-Sikorski bill which would mandate reductions in a particular manner, that is, by the installation of scrubbers.

Is it fair to say that that is the principal message that you bring to us today?

Governor SCHWINDEN. You said it well.

Governor MATHESON. Yes.

Governor SUNUNU. Yes.

Senator MITCHELL. In considering that first question, one of the major issues is, of course, the potential economic effects in principally the Midwestern large emitting States and much attention is focused on the question of coal mining employment. In that regard, I think the Governors would be interested to read and I will ask permission, Mr. Chairman, to have inserted in the record the results of a study, completed in September 1983, prepared by an organization known as ICF, Incorporated which is a consulting firm in the business of analyzing legislation. The study contrasts the two basic concepts, that is, of technology mandated reductions as set forth in H.R. 3400 or the concept established in the legislation which I introduced a couple of years ago which simply says we set the limit and leave it up to the States and the affected industries to devise the best method.

I will simply briefly, if I may, in my time, describe the principal conclusions of that study and then I will ask that it be placed in the record and copies be provided to the Governors if they have not already seen it. Because it very strongly supports the position that they have set forth today.

The study found that what they call the cost-effective program would have little effect on mining employment. It found as its principal conclusions that coal mining employment would go up 52 percent over 1980 levels, that the 21 coal producing States in the East and West would gain 138,000 jobs by 1995, that there would be employment declines in 4 States but 98 percent of those declines are in 2 States, Ohio and Illinois.

So, just two States would be seriously adversely affected by loss of employment, and the cost-effective acid rain control program would actually add new jobs to several States.

It also found that H.R. 3400 which is the technology mandated reduction would cost consumers and taxpayers enormous sums. It would do so and it found four conclusions, first, capital costs under that program would be 14 times greater, second, annual operating costs would be 48 percent greater, third, total mining employment would be actually lower under that proposal and, fourth, they are saying scrubbers produce no net gains in environmental benefits despite the huge increases in cost.

I think it is a significant study and one which bears directly on the crucial question of what to do and strongly supporting the Governors' position. Therefore, Mr. Chairman, I think it is relevant to ask that it be placed in the record at this point.

Senator STAFFORD. Without objection it will be. (See p. 207.)

Senator STAFFORD. Thank you very much, Senator.

Senator Burdick told me he was leaving because he didn't want to get his arm broken a second time.

Senator Baucus.

Senator BAUCUS. Thank you, Mr. Chairman.

Governor Sununu, some discussion thus far has been on the acid rain causes and the premise is it is caused by a high- or low-sulfur coal, that is, it is a sulfur dioxide that cause the problem. I am wondering, given your background, the extent to which you and other Governors have looked into the degree to which nitrogen oxides contribute to acid rain.

Governor SUNUNU. There is evidence that there is a contribution from nitrogen oxides. The impact is a little bit more local in the sense that the transmission lengths for persistence of the characteristic of the SO_2 is a little bit longer. There are provisions in some legislation and in fact in the packages endorsed by the New England Governors which would permit some tradeoffs in the reduction techniques used by the States for nitrogen oxide, generally recognizing the severity of SO_2. It has been recommended that the tradeoff be only 2 pounds of NO_x reduction for every 2 pounds of requirements on SO_2. I suspect the great deal of the problem in California on the acid fog-acid smog is primarily NO_x based.

But I would hope that legislation merely recognized this as an additional constructive step and that we don't confuse the process by suggesting that we need greater study to quantify exactly the relative impact of NO_x to the impact of SO_2.

Senator BAUCUS. Generally you are saying that you hope that, yes, the bill recognizes the nitrogen oxide problem but that the further you try to identify that precisely, try to remedy that might cloud the issues, so to speak, and make it more difficult to keep our eye on the ball which is sulfur dixoide?

Governor SUNUNU. That we include investment for the research and development associated with that, but that not be used as an excuse for inaction on the SO_2 question.

Senator BAUCUS. You mentioned also in your testimony that you thought that this bill, the bill that this committee has passed might in fact help high sulfur coal areas. What did you mean by that?

Governor SUNUNU. I am convinced that the principal energy resource this Nation has is coal, high-sulfur, low-sulfur coal and that a long-range energy policy for this country is dependent on us being able to use that effectively. If all we do is end up with the perception on the part of the public that coal is a health hazard, as an impact and is a negative fuel, it has a negative perception to the use of that fuel, we will inhibit the investment that is necessary I think to bring that to market quickly and effectively.

Senator BAUCUS. So what you are saying is the bill that this committee passed last year and is working on now, will help, not only the low-sulfur-coal industry, but also the high-sulfur-coal industry?

Governor Sununu. I think a good sound bill could help both low- and high-sulfur-coal industry, to bring their energy and their fuel to market on a timely basis.

Senator BAUCUS. Third, would you agree that the present law mandated percentage reduction is improper or unfair to the West?

Governor SUNUNU. Senator, I think that in any law we could find regional differences. But the question of fairness I think deals both with the specific results obtained and the advantages of a local policy toward the environment. We have policies toward the environment and percentage usage that involve strategies for investment and providing clean water and I can argue that the clean water policies of this country are much more significantly advantageous to the West. Taken as a whole there are distinctions in that legislation that have regional differences but I wouldn't characterize it as unfair.

Senator BAUCUS. It does favor one region of the country over another?

Governor SUNUNU. No more than any piece of legislation.

Governor SCHWINDEN. If you look at it from a slightly different perspective, Senator, in terms of Governor Sununu's response I think the problem with percentage reduction is that it violates a couple of principles that have already been enunciated by the Governors today. One is it essentially violates the principles that the States ought to have the responsibility to approve the mechanisms that are mandated by the Federal legislation, so it denies that flexibility that Governor Matheson articulated a little earlier. Second, it tends to distort the costs of pollution control. I guess you can argue the equities of those but the fact is it essentially locks in high-sulfur coal in many cases and locks out low sulfur and indeed also locks in a kind of single control technology in its application to the problem.

It happens that that poses some very serious problems in the West in terms of equity but I suppose it is also right in saying that it is hard to find any piece of national legislation that doesn't do that. But its net effect does cause dislocations.

Senator BAUCUS. What about the other side of that same coin? As you know, there are lots of very strong environmental groups in the West, particularly in our State, what do you say to them when they say that this is really an antienvironmental provision rather than taking the environmental approach generally in this bill which is to clean up the air?

Governor SCHWINDEN. What I say to them is probably not enough to sooth their concerns but as I tried to point out in my testimony, the difficult task facing this committee and the Congress is to find a political solution to a problem that is very divisive. In a country which is struggling hard to survive international competition, we have to also assess the cost effectiveness of the kinds of methods that we adopt to try to reduce problems as acute as acid rain.

In this case, the costs that are associated with dictating in effect one control technology which is scrubbers adds up to many billions of dollars which are therefore not available to other parts of our industrial economy. I think our basic point is we ought to continue to prioritize cost effectiveness as not a totally satisfactory answer to the environmental concerns in Montana or elsewhere but it is one that must be made from the position of political leadership.

Senator BAUCUS. I see my time is up. I want to applaud you all very much. I think the committee agrees with all of you in saying we need this bill. We need to move in this direction from the environmental point of view. We have got a problem in our country not only in terms of the air and water but also with our neighboring country, Canada. We have to move very quickly. I also applaud your regional approach. I might say though as a representative from the State of Montana that I am going to be protecting the Western point of view here just as New England will be protecting New England's point of view and the Midwest protecting the Midwest point of view. Politics is, as you know, perhaps better than anyone else in this room, in putting all of that together I am going to be standing up for the Western point of view as best I can.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you very much, Senator.

Senator Randolph.

Senator RANDOLPH. Thank you, Mr. Chairman.

Governor Matheson, I remember you speaking to a group of Democrats last year. They were talking about the problems in those States. I will never forget hearing you say, I don't want to talk about any of these fancy problems, I need money from the Federal Government to help me provide sewage plants in Utah. Is that what you said?

Governor MATHESON. I certainly did.

Senator RANDOLPH. I will never forget that.

Governor MATHESON. You have a good memory, Senator.

Senator RANDOLPH. I am not sure what you are asking for today but I knew on that occasion. The cutbacks you were against.

Governor MATHESON. Yes. You were very helpful in getting us $2.4 billion for the construction grants program that year.

Senator RANDOLPH. I wanted you to say that.

Mr. Chairman, I feel that there is enough desire and enough determination within the Federal and the State Governments and other political subdivisions that we can solve this problem. We have to be willing, is it not true, to make accommodation if that result is to be consummated? I think you would all say that that is true because what we have to have is not only workable but it has to be, insofar as possible, equitable as we reduce the acid rain over America.

Is that correct? Are you and others, do you believe, willing to help us? I don't think it is an issue that can be indefinitely delayed. I think we have to come to grips with it. We are trying to do that within this committee as we have on a dozen subjects in the past few years. So I would like to be positive this morning although someone might say it is a positiveness that has perhaps another direction than the one that I would desire.

Mr. Chairman, I hope you can have as many hearings as possible in these days and weeks of this session. I thank all of you very, very much including Senator Danforth. We share your viewpoints and also your convictions in these matters.

Senator STAFFORD. Thank you very much, Senator Randolph.

I am sure the Governors would be willing, if asked, to respond to an inquiry from our chairman emeritus on the subject of acid rain.

Senator Domenici.

Senator DOMENICI. Thank you very much, Mr. Chairman.

I am about to hear from two of the Governors and I apologize for having missed the other two. I will try to be brief.

Those who propose a national tax on our utility customers across the country to pay for this cleanup seem to me to forget that there is a great disparity in utility rates now, a significant portion of it being based upon the amount of money spent and planned to be spent to clean up emissions. That is kind of their hidden tax and it is big. There are those that think out in States like New Mexico, we are attracting new growth because of low utility rates. Quite to the contrary the biggest negative frequently alleged is the high cost of utility in States like mine.

I don't know about Utah, but I imagine it is very similar. Could I ask the Governors if there has been an indepth study of the States by the Governors' Association as to the utility rates for a coal-generated electrical bill with some perspective placed in those overall assessments in terms of percent for cleanup technology and modernization? Does any Governor know if that has been done?

Governor SUNUNU. We do have it, Senator. The study was done on the basis of half a dozen sample proposals. It shows not only the dollar increase associated with a full dependence on an emission tax or with full dependence on a fossile fuel surcharge but it also shows a 50-50 combination and a two-thirds combination.

Senator DOMENICI. Governor, I am talking about right now before we put any surtax on, putting on some chart what the utility rates are now in the various States and how much of that is for cleanup?

Governor SUNUNU. I am sure we can grind that out for you if you would define what you mean by cleanup. If I may just point out, the policy for utilizing hydropower in lieu of coal may have as part of its decisionmaking process cleaning up.

Senator DOMENICI. I don't want to have an argument with you. Are you arguing with the Governor from Montana who says his rates are effected 30 percent by environmental concerns they have? Are you arguing with the Governor from Utah? If you are not, why argue with me. That is the same information I want except I would like it from all States. My hunch is the States that are dirtiest and contributing most have the lowest utility bills now and have done the least to clean up. I just think we ought to know about it if that is the case. That is just my gut. Can we get that information or not?

Governor SUNUNU. Senator, I am sure the information can be obtained. I am just trying to understand the context of your question. He was pointing out the cost on a given coal facility. I am trying to point out that the decision to build a hydro facility has inherent in its overall investment cleanup. I don't know what percentage of the total cost of the hydro facility to assess to cleanup. The construction of a nuclear facility in lieu of coal has some consideration due to the level of emissions. I will be very happy to try to give you the total number. But I do want to point out that in the interpretation there is going to be a problem.

I certainly feel exactly the way you do in terms of the conclusion. I am just suggesting that like most quantitative data that would be generated it is going to be subject to a great deal of interpretation.

Senator DOMENICI. Do we have that information, Mr. Chairman, anywhere?

Senator MITCHELL. If I may respond, I think the Senator makes an excellent point. I would point out we have information on what the current rates are. They certainly confirm precisely what you have suggested. They are very substantially lower in the large emitting States. I do not believe that we have though the breakdown of the extent to which the higher rates in other States are based upon or precisely based upon cleanup. But I think that would be a very valuable contribution if we could somehow get that information.

Senator DOMENICI. Mr. Chairman, could we ask the Chair to see if we could get that some way?

Senator STAFFORD. I am sure we can develop that information. We will ask the staff to set about getting it.

Governor MATHESON. May I offer just a comment about Utah directly relevant to your question, Senator? We are building two brand new powerplants in Utah now. One is 1,500 megawatts and the cost of the pollution controls on that plant are $308 million, just over 20 percent of the total capital cost of that plant. The second one is the Bonanza plant in eastern Utah. That is 400 megawatts. And $155 million or 22 percent of the total capital costs are for pollution controls, basically scrubbers in both instances just to give you an idea what is happening in our State.

Senator DOMENICI. My point is I tend to equate that in your State and a similar one in his State and a similar amount in my State to our tax. That is what I am trying to point out. We are kind of paying our tax.

I thank the Chair.

Senator STAFFORD. I thank the Senator very much.

Senator Humphrey.

Senator HUMPHREY. Mr. Chairman, our witnesses have been on the griddle for a long time. I will just ask one question and submit the other in writing if I may. Let me direct it to Governor Sununu.

You have a background in engineering as I pointed out and likewise because of your expertise in the electrical energy area you have been a consultant to that industry. With that background what do you think of the estimates by some utilities that acid rain could cause perhaps a 50-percent increase in utility rates?

Governor SUNUNU. Senator, I don't agree that an imposition of a total cost in this country which represents 2 or 3 percent of the total electrical bill maybe 4 percent depending on the flavor of the legislation you are looking at, will produce a 50-percent increase in electric rates. The art of drafting that legislation constructively will be to make sure that no unfair burden is carried by any single utility. The evidence given by both Governor Matheson and Governor Schwinden indicates that in today's facilities that are being constructed under criteria that are as stringent as any criteria that you would include in your legislation, that they are talking about upper limits of about 20 percent, 30 percent in cost.

In addition to that, if you look at the kind of legislation that is being proposed to bring emission levels down to either the 2 pounds per million Btu of SO emissions or in other cases 1.2 pounds are those that are significantly higher than the levels of emissions that are being addressed by the facilities they are talking about.

I have the feeling that in reality we are looking at about a 4-percent average weight with perhaps some utility to utility differences that might be as high as twice as much as that.

Senator HUMPHREY. Where then do some of these utilities get the figures like 50 percent? What rhyme or reasoning brings them to that conclusion?

Governor SUNUNU. It is the point I was trying to point out in my answer to Senator Domenici. If you don't make clear what you are asking for in the data, the data can be subject to a variety of interpretations. I think what you are looking at is perhaps some honest but selective interpretation of numbers by those who are choosing them.

Senator HUMPHREY. Thank you.

Senator STAFFORD. Thank you, Senator.

Governor SUNUNU. May I add one point, Senator, that I think is very important?

Senator STAFFORD. Indeed you may.

Governor SUNUNU. We have talked today about regional differences. Those of us who come from States that border on Canada are very cognizant of other differences in utility rates and that is international differences in rates.

Utilities in other countries that are operating under less stringent regulations look to our country as a market for their electric power. I think the northern New England States are very much in the process of recognizing that there is an availability of that energy.

My concern is that we do not, in the legislation that we are putting together, put ourselves in the position that is inconsistent with allowing us to generate our own power in this country.

With all due respect to our neighbors to the north who have done a tremendous public relations job and terrible in terms of the reduction job in addressing the acid rain issue, I think we must be cognizant of that.

Let me give you two statistics that we must be aware of. The Canadians have about one-fifth of the total emissions that we do. They have one-tenth of the population. Therefore on a per capita basis they have twice as much, twice as much emissions as we do of sulfur dioxide going into the air and on a per unit of industrial output which is a critical criteria they have three times as much.

I have pointed out to them and I think the record should show that when the Canadians achieve a 50-percent reduction, they will then and only then be at the point we are today in terms of per capita emissions.

I think that any legislation that tends to stimulate a relationship across the border ought to understand the point from which we are really negotiating. This country has done a tremendous job in reducing. We have to do a great deal better job in reducing but we ought not let the rhetoric coming from the north suggest to us that anybody else has done better.

Senator STAFFORD. Thank you, Governor.

The Senator from Verront has carried somewhat the same message to Canada on some occasions. So we are acting in concert in that respect. I think if there are no more questions, for the committee I would, again, express our appreciation to the Governors for your help in this very major problem we are facing.

Thank you, again.

There are two more important witnesses before our committee. So I would ask our guests to leave as quietly as possible.

I would ask the next panel, Dr. Ellis Cowling of North Carolina State University and Dr. Arthur Johnson of the University of Pennsylvania if they would come to the witness table.

Doctors, the Chair would invite you to proceed in any way you wish. If you would understand that we would appreciate it if you could summarize your testimony in possibly 10 minutes, would that be agreeable? Is that practical?

The committee, unfortunately, is beginning to face some other pressing engagements. Or we would allow more time.

Dr. Cowling.

STATEMENTS OF DR. ELLIS COWLING, PROFESSOR, NORTH CAROLINA STATE UNIVERSITY; AND DR. ARTHUR JOHNSON, PROFESSOR, UNIVERSITY OF PENNSYLVANIA

Dr. COWLING. Senator Stafford, we are prepared to display for you at Mr. Moore's request four observations or four phenomena, evidences of change in the growth and behavior of forests.

We will talk about the changes in the general forest; we will talk about the changes in the forests on top of Mount Mitchell in my State of North Carolina; we will present, I think, publicly for the first time some forest survey information that indicates changes are taking place in the southern pine forests and Art will further talk about some observations he has made showing growth reductions in a region extending from Maine to North Carolina.

We will display these things for you. Art will then offer some comments and we look forward to joining together in the discussion. We will start with the German forces. The Germans call the phenonenon they see there in the death of forest Waldsterben.

If you look at the tree on the left, you can see that you cannot see the stem of this tree. If you look at the tree on the right, you can see that you can see the stem. That is the way to tell the difference between a healthy tree on the left and a sick tree on the right. These trees here are ill. That is a spruce tree. You can see that it shows its stem. No self-respecting fir tree ever shows its stem. This is a tree in a very severe state of decline, a series of trees.

There are four species of trees, pine, spruce, fir, and——

Senator STAFFORD. Doctor, what was the altitude?

Dr. COWLING. I don't know specifically in this case. But these kinds of observations have been made at low elevation, at mid and high elevation.

Senator STAFFORD. Has there been adequate rain in that area?

Dr. COWLING. Yes. There has also been drought in Germany as there is drought in this country. We will show evidence today that drought sometimes but not always is associated with what we are showing you today.

The thinning out of the crown is what we see commonly in four species of trees. These trees are in very severe state. These trees sometimes show a dying of the foliage from the inside near the stem outward. They show a peculiar habit of branch growth. These branches hang down. They do not normally hang down on spruce or fir trees. The trees actively cast their green leaves, a very unusual symptom, something that has never been observed at all before anywhere in the world except occasionally in the case of oak wilt in this country.

Beech as well as other hardwood trees show the same phenomena, a decline in general habit of development. Peculiar shapes of leaves and the active casting of green leaves which is a very remarkable symptom of stress in the trees. These beech leaves have lobes. They don't normally have lobes. So their habit of growth has changed in a significant way. Here are crystals of calcium sulfate in the trees, of spruce. You can imagine how effective they would be as a port for entrance of carbon dioxide and oxygen. Not only the trees suffering in Germany, but the fern suffers in Germany.

This looks like it is killed by frost. But it is killed by something they don't know. The forest of Germany at high elevation is often very lush and green. But occasionally they observed under affected trees that the vegetation beneath the trees is entirely killed.

This very sharp border between the surrounding green vegetation and the dead area underneath the crowns of affected trees cannot be explained by any observation of science. So there are some peculiar things going on in the German forest today. This forester shows this very sharp border between the region affected in the vegetation and the region not affected nearby.

Let's come back to this country. Here is the top of Mount Mitchell, the highest point in Eastern North America. I think all would agree a beautiful place to visit. We have a weather station on top of Mitchell which gives us some insight at least into precipitation.

You asked about drought and elevation. This is a very wet area. It is a rain forest, you might say, average 81 inches of rain every year. There is an epidemic caused by the balsam woolly which is causing the death of fir on top of Mitchell. There are two species, spruce and fir growing together.

At low elevation, as you can see here, the young spruces are coming in among the dead firs, the dead firs being killed by the insect.

This is a health condition at low elevation. At high elevation, you see two dead firs and one very sick spruce. It is the spruce, not a fir, that is showing the symptom at high elevation.

At low elevation you have good reproduction of spruce; good reproduction of fir. But at high elevation, you have very poor reproduction of any plants of any sort on top of Mount Mitchell above 6,300 feet. No reproduction at all; we have made observations, my colleague, Robert Brook, in our department of pathology, of the metals deposition, of the acid deposition and of the growth of friendly fungi that help trees' growth.

They have measured the moisture. Here is the data showing that in the years where growth suppression occurred around 1962, these were wet years on top of Mount Mitchell despite the fact that they were drought years in other parts of the country.

We have no reason to suspect that drought is the cause of this. We have looked at the mycorrhizae, a fungus root association in the soil, which is very valuable for the trees.

At low elevation, they show disappearance which is very attractive to one who understards mycorrhizae, and when you are high elevation you see sick looking mycorrhizae. These are very functional organs unable to do their job of getting nutrients from the soil. We have done control experiments at the ambient rain condition in North Carolina. We have an average pH in 1983 of about 4.2 in North Carolina. Robert Brook has done experiments where he has applied simulated rain and various pH's and observed the frequency of these fungal root associations, these mycorrhizae as we call them.

You see at pH 3.2 or 3.4, you have many fewer of these beneficial fungi growing with the roots. At very acid conditions, you have very good development, at pristine conditions, pH 5.6, you have very good mycorrhizae. This is what they look like at pristine conditions in very good health, this is what they look like at very acid conditions, also in very good health and in between at the same pH's that we have on the average in precipitation at North Carolina, you have dead or dying mycorrhizae and at pH 4 they look very dead indeed.

We do not know that acid deposition is the cause of these phenomena, either in Germany or in North Carolina but we do believe that air pollution in some way is likely to be involved.

The next data I will show are from the forest survey. These are data collected recently by the U.S. Forest Service. These, when you look across, you see DBH class, so you have 6-inch, 8-, and 10-inch trees and on the vertical axis you see the growth rate of these trees of 6 and 8 inches.

When you see 4 that means the fourth forest survey ending in this particular State of Georgia in 1978 to 1980. When you see— that is the fifth one. The fourth one is a decade earlier.

So you see here no important difference between the most recent decade and the previous decade. But now let us look at other parts of Georgia and other parts of other kinds of species. This is Georgia loblolly pine.

Notice the fifth forest survey shows slower growth than the fourth, a 10-year span of time in each case, slower growth recently. That is true in Georgia loblolly pine, the most important timber species in the South.

This is Georgia shortleaf pine, the recent decade shows slower growth than the previous, the same thing is true of loblolly in another survey district within Georgia. This is largely in the Piedmont region, again loblolly and shortleaf pine in Georgia appear to be growing much more slowly than they did in the prior decade.

Let's turn to Alabama. Same thing, notice 1982 survey data compared to the 1972 survey data show that loblolly pine in Alabama in the Piedmont is also growing substantially more slowly than it was in the previous decade.

Here is Alabama shortleaf pine. Here is Alabama loblolly pine in another of the survey districts. Here is South Carolina loblolly pine in an interim survey, done specifically to look at the possibility of these effects, compared to the fifth survey and again the most recent evidence is that the forest is growing more slowly.

In South Carolina again, loblolly pine, in South Carolina is slash pine. These data we do not know the cause of these effects. We only know that the data support the general inference that the forest is growing more slowly now than it was growing a decade ago.

I will turn this over now to Art.

Dr. JOHNSON. Thank you, very much.

I would like to add just a few more slides here which extend the geographic extent of the growth anomalies and unexpected mortality to the region extending from Tennessee to Maine.

This is a slide of a tree core. This is a cylinder of wood approximately the dimensions of a drinking straw which we extracted from the trees to look at annual rings.

Each combination of light and dark wood represents an annual ring. We can deduce from these trees certain things. The most important is the pattern of growth in recent years. The dark object at the top of that core is the bark and the last 25 years show very clearly that there has been a dramatic reduction in growth in this particular instance.

When we first observed this in New Jersey in 1979, we thought it was a curiosity, but in the past 5 years, we have found that substantial portions of the populations of at least three coniferous species show this effect, the preliminary indications are that at least three other coniferous species show this effect.

It is reasonably common from Tennessee to Maine. It is unprecedented in the tree ring record. We see this effect in trees of all ages occurring at approximately the same time. Thus it is not an effect of aging. It begins rather abruptly usually in different years in different trees.

This effect first becomes visible in the late fifties or in some cases, the early sixties.

This represents a loss of productivity and a loss of vigor and possibly a predisposition of disease triggered by other stresses.

One other thing to note about this kind of tree-ring pattern is that it is also widespread occurrence among German conifers that, this effect became apparent approximately 20 years before the mortality was observed.

The widespread occurrence of this tree-ring phenomenon has been documented by sampling large numbers of trees at approximately 50 sites in 8 Eastern States.

On this slide—and Camels Hump is in Vermont—we show the three main species for which we have good evidence, red spruce, pitch pine, and short leaf pine. The geographic range included in this slide is Vermont, Virginia, New York, Tennessee, and New Jersey.

Senator STAFFORD. Thank you for giving us Camels Hump.

Dr. JOHNSON. Camel's Hump is indeed in Vermont. I wanted to put in a slide about the State of Maine. This is a graph showing the calendar year across the horizontal axis and the radial growth rate in millimeters on the vertical axis. The data are from a national park in Maine and the rather abrupt change in the growth rate in about the sixties.

Looking at New Hampshire, these are cores taken from moderate to high elevations on Mount Washington, the highest peak in the Northeast. The species here is red spruce and the ring compression is quite typical of what we see in spruce growing at moderate to high elevations in the Northeast and at very high elevations in the Southern Appalachians.

This effect in spruce is of special interest to us because it is a precursor to dramatic and widespread mortality of spruce in the high elevation forests of New York, New Hampshire, Vermont, and North Carolina.

We suspect that very shortly, very good evidence will be found to show that this occurs also in parts of Tennessee and Virginia. This is a photograph taken at 3,000 feet on Camel's Hump in 1964. The same stand taken essentially from the same place in 1981 looks like this.

I think you are well aware of this phenomenon so I shall summarize quickly. The remarks that we have made today about the U.S. forest are the result of data gathered by many scientists from measurements of tens of thousands of trees at thousands of sites in 14 States east of the Mississippi, a rather clear message has emerged.

Many species of conifers show unexpectedly low growth rates over the past 15 to 25 years accompanied in at least one case—red spruce—by dramatic and widespread mortality.

The unexplained reductions in growth and increases in mortality have been observed in six or seven coniferous species in Maine, New Hampshire, New York, Vermont, New Jersey, Virginia, Tennessee, North and South Carolina, Georgia, and Alabama.

I hasten to add that the factors which are involved in these phenomena are presently not known. They may be different in different areas and the role, if any, of acid deposition has not been identified at this time.

The findings in North America have been derived from studies of tree rings carried out by many investigators in many locations, and from repeated measurements of tree diameters carried out largely by the U.S. Forest Service. Tree ring studies conducted in central and northern Europe have shown the same anomalous patterns in diameter growth rates in recent decades, followed by alarming incidences of decline and mortality in several species.

Because the changes are substantial and cover broad geographic areas of esthetically and commercially valuable forests, identification of the cause or causes of these unexpected trends in growth and morality should be a high priority. Because these changes have been identified in areas receiving moderate to heavy rates of acid deposition, and because the changes occurred during a period when acid deposition has intensified and spread, considerable speculation exists as to how acid rain might be involved. The current state of our understanding based on sound scientific investigations is as follows:

One, substantial and easily visible changes in growth have been identified in tree ring studies of some conifers across their ranges in the Eastern United States. This phenomenon is well documented in eight States and three species, pitch pine, shortleaf pine, and red spruce.

Preliminary indications are that this phenomenon is apparent in other species of conifers. The change to abnormally small yearly growth increments is generally rapid and is observed in a substantial proportion of the populations.

This change to reduced growth apparently signals the onset of stress, and it occurs after 1955, but in different years in different trees. Trees in all age classes are affected. We have been unable to explain this rather synchronized, regional and long-lasting effect solely on the basis of natural growth-controlling factors such as weather patterns, drought, temperature anomalies, competition, disease, insects, or catastrophic events such as ice storms, hurricanes, and so forth.

Senator MITCHELL. Could I interrupt there for a moment on the question of drought?

Do I understand what you just said is that the onset occurred over a wide area at approximately the same time and since weather conditions, for example, drought are not uniform throughout all of those areas that therefore you tend to discount drought as a cause of this?

Is that a fair understanding of what you said? If it isn't, please explain it to me.

Dr. JOHNSON. I think that I tend to discount drought as the sole factor involved in this phenomenon. We think that it does contribute in several cases. I think the evidence can be marshalled in good scientific reasoning to suggest that it is involved.

We don't, at the present time, see it as the only major cause of this phenomenon.

It is reasonable to suspect that airborne pollutants alone or in combination with natural stresses could be involved.

Two, forest survey data from the Piedmont region of the Southeastern United States show very clearly unexpected, reduced growth of economically important conifers in the seventies compared to the sixties. These findings are new, and the meaning of this reduction in growth and the factors responsible are not known. The two most important timber species in the South, loblolly and slash pine show inexplicably low growth rates across all of the Piedmont in Alabama, Georgia, and South Carolina.

Three, unexplained, massive mortality has occurred in red spruce in high elevation forests of the Appalachians. This type of mortality has been documented in North Carolina, New York, Vermont, and New Hampshire, and will likely be clearly identified in other areas soon. Whether or not anomalous mortality has occurred in other species of the high elevation forests is uncertain at present.

Four, the high-elevation forests of the Eastern United States are subject to extremely high rates of acid deposition, and other airborne substances compared to low elevation forests of the East.

The high rates of input result from high rainfall amounts and prolonged, frequent contact with clouds which cap the mountains. The substances for which we have adequate documentation include sulfuric acid, acidifying nitrogen compounds and heavy metals, particularly lead. Thus by comparison to most of the forests in the

Western Hemisphere, the remote mountain peaks of the Appalachians are highly polluted environments.

I think it is worth repeating that statement, that by comparison to most of the forest in the Western Hemisphere, the remote mountain peaks from North Carolina to Maine are very highly polluted environments.

Determining whether or not the mortality in spruce and the anomalous growth trends are related to acid deposition or other pollutants is complicated by several factors. At this time, no symptoms attributable to a specific pollutant or to a specific type of failure in the plants have been identified.

We do not know how resistant the plants or the ecosystems are to ambient doses of the individual pollutants, or combinations of pollutants, or how pollutant and natural stresses interact. We are currently unable to conclusively rule out natural stress as a primary cause in most of the cases.

Senator MITCHELL. Does that mean manmade?

Dr. JOHNSON. Yes, sir. There is currently no consensus among the scientific community about the involvement of acid deposition in the anomalous growth and mortality patterns observed here and in central Europe.

I stress that there is no clear evidence that acid rain is involved, and there is no clear evidence that acid rain is not involved. It is an open question.

I suggest that any political decisions made with our current level of understanding should take into account that recent trends in growth and mortality are, in many cases unfavorable, that these trends have been identified in areas receiving a mix of pollutants including acid rain, and that the sum of the evidence suggests that airborne pollutants are reasonable possibilities as major contributors. Convincing evidence regarding the involvement of sulfur emissions could emerge from ongoing and planned research, but that evidence is not presently in hand.

Senator STAFFORD. Thank you, both, very much.

I think it is intriguing that in the data you have shown us, the sharp reduction in tree growth began to show up around the middle 1950's. And the data that you have been discussing, I assume, you have taken into consideration the fact that in approximately 1950 the sulfur oxide loading of the atmosphere in this Eastern 31 States was about 10 or 11 million tons per annum and that by 1977, it had increased to approximately 26 or 27 million tons per annum and during that same time period, the smokestack industries and large utilities had gone from relatively short to very tall stacks which meant dispersing their emissions into the upper atmosphere.

You considered those factors, I assume?

Dr. COWLING. Art is part of the committee under the sponsorship of the Triacademy Committee on Acid Deposition and they are examining these various trends, trends in growth rates in forest, trends in emission patterns, trends in our industry in an attempt to try to show the correlations or lack of correlations among these various spectacles.

Senator MITCHELL. I think in reference to the very high peak in North Carolina that your testimony was to the effect that there was no lack of rainfall there. So that lack of rainfall could not have been a contributing factor to the damage to trees there.

Dr. COWLING. That is correct. it is related to Senator Mitchell's question in other parts of the country. We have good reason to believe that there is an association between this anomalous growth pattern and drought. On Mitchell we have no good reason to make that association.

Senator STAFFORD. I cannot say this from complete personal knowledge but my impression, strong one is that both Mount Washington and Camel's Hump in my State also have adequate rainfall.

Do you know of anything to the contrary?

Dr. JOHNSON. I would like to discuss that a little bit since we have done some of the work that I think has been cited and quoted and I think, perhaps, misunderstood.

What we have suggested is and we have done this repeatedly in several publications is that we see the decline in spruce and a syndrome involving perhaps three categories of distress, a predisposing stress which will set the tree up for severe damage from an acute stress and then following that acute stress invasion by secondary root rot fungus or bark beetles or something like that which are lethal.

So we think there may be predisposing stresses which may be air pollutants, a stress which could be drought, severe frost or a lack of moisture as a triggering event not necessarily the whole cause and then invasion by lethal micro-organisms or insects as a category of stress.

It is, I think, quite clear in the case of pitch pine in southern New Jersey that this effect shows up exactly in the most severe year of drought which is 1957. The only years of drought in Vermont for the past 85 years have been in the early sixties and it is possible that there was some degree of moisture stress on Camel's Hump and in the White Mountains during that period of time which have caused this effect to be manifested, simply another stress which the tree has to deal with.

Senator STAFFORD. Thank you, very much.

I presume, Dr. Johnson, you are familiar with the work being done at the Aiken Natural Resources Center at the University of Vermont?

Dr. JOHNSON. Yes, I am.

Senator STAFFORD. Which has been practicing some of the same things that you two gentlemen have showed us here today.

Thank you, both, very much.

Senator Mitchell.

Senator MITCHELL. No, Mr. Chairman. I have to go to another meeting. I don't have any questions. I thank both doctors Cowling and Johnson for their statements. They will be very valuable.

Senator STAFFORD. I join in that for myself and the whole committee. We are very grateful to you both for coming here this morning and helping us.

The committee will be in adjournment until the next hearing which will be on Thursday.

[Whereupon, at 12:20 p.m., the committee recessed, to reconvene on Thursday, February 9, 1984.]

[Statements submitted for the record follow:]

STATEMENT OF SENATOR JOHN C. DANFORTH
ON ACID RAIN AMENDMENTS TO S. 768
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
FEBRUARY 7, 1984

MR. CHAIRMAN, I WAS HERE TWO YEARS AGO TO DISCUSS ACID RAIN, AND I AM HERE AGAIN TODAY TO DISCUSS ACID RAIN. I HOPE THAT I AM NOT BACK HERE TWO YEARS FROM NOW DISCUSSING HOW TO GET STARTED ON REDUCING ACID RAIN. I BELIEVE WE OUGHT TO GET STARTED NOW.

WE ARE CURRENTLY AT A LEGISLATIVE IMPASSE ON THIS ISSUE, AND THE REASON, IN MY OPINION, IS REALLY VERY SIMPLE: THE FRAMERS OF ACID RAIN LEGISLATION HAVE PLACED VIRTUALLY ALL OF THE COSTS OF CLEANUP ON THE INDUSTRIALIZED STATES OF THE MIDWEST FOR A PROGRAM THAT WOULD LARGELY BENEFIT THE NORTHEAST. THIS IS A DIVISIVE APPROACH, PITTING STATE AGAINST STATE, REGION AGAINST REGION. IT IS UNSOUND POLICY, BOTH POLITICALLY AND SOCIALLY.

I WAS AN ORIGINAL COSPONSOR OF SENATOR MITCHELL'S LEGISLATION TO COMBAT ACID RAIN. BUT I CAME BEFORE YOU IN 1982 TO SUGGEST A MODIFICATION OF THAT BILL, WHICH I PUT FORTH AS S. 2594, IN AN EFFORT TO FORESTALL REGIONAL DIVISIVENESS. YESTERDAY I AGAIN INTRODUCED THAT PROPOSAL--THIS TIME IN THE FORM OF AMENDMENTS TO S. 768. I CHOSE THIS TIME TO OFFER AMENDMENTS IN ORDER TO DEMONSTRATE THAT MY INTENT IS NOT TO

QUARREL WITH THE COMMITTEE'S GOALS, BUT ONLY TO FINE-TUNE ITS APPROACH.

MR. CHAIRMAN, I WOULD LIKE TO ADDRESS MYSELF TO THE TWO ASPECTS OF THE ACID RAIN QUESTION UPON WHICH MY LEGISLATION FOCUSES--THE RELATIVE CONTRIBUTION OF LOCAL AND LONG-DISTANCE SOURCES, AND THE COST OF A CLEANUP PROGRAM.

THERE IS GENERAL SCIENTIFIC AGREEMENT THAT LONG-DISTANCE TRANSPORT OF SULFUR DIOXIDE EMISSIONS CONTRIBUTES TO ACID RAIN. WHAT IS NOT AS CLEAR IS THE RANGE OF DISTANCE INVOLVED. COMMON SENSE TELLS US THAT PARTICLES EMITTED FROM A SMOKESTACK WILL FALL TO THE GROUND, AND THE CLOSER YOU ARE TO THE SMOKESTACK, THE MORE PARTICLES WILL FALL ON YOU. CONVERSELY, THE EFFECT OF A SMOKESTACK HUNDREDS OF MILES AWAY WILL BE LESS THAN ONE 50 MILES AWAY.

AS THE REPORT OF THE NATIONAL ACADEMY OF SCIENCES PUT IT, "IT CAN BE STATED AS A RULE OF THUMB THAT THE FARTHER A SOURCE IS FROM A GIVEN RECEPTOR SITE, THE SMALLER ITS INFLUENCE ON THAT SITE WILL BE PER UNIT MASS EMITTED." WORK DONE AT WASHINGTON UNIVERSITY IN ST. LOUIS SUGGESTS THAT SULFATE EMISSIONS TRAVEL NO MORE THAN 600 MILES.

THIS PRESENTS A CONUNDRUM FOR A SENATOR FROM MISSOURI. ON THE ONE HAND, MISSOURI CONTAINS SOME OF THE WORST SULFUR EMITTERS IN THE COUNTRY. ON THE OTHER HAND, NONE OF THEM APPEARS TO BE WITHIN 600 MILES OF AN AFFECTED ECOSYSTEM. SHOULD A CLEANUP STRATEGY INCLUDE MISSOURI OR NOT?

ALL OF THE ACID RAIN PROPOSALS TO DATE HAVE ESTABLISHED A 31-STATE "TRANSPORT CORRIDOR." THE REPEATED USE OF THIS REGION IN STUDIES OF ACID RAIN HAS SUGGESTED A TACIT SCIENTIFIC ENDORSEMENT OF THE REGION, WHICH ENDORSEMENT IN FACT DOES NOT EXIST. I WOULD SUGGEST, MR. CHAIRMAN, THAT THIS PARTICULAR EMPEROR HAS NO CLOTHES. IT IS SIMPLY A LINE ON A MAP. WHAT RATIONALE, FOR EXAMPLE, WOULD INCLUDE ARKANSAS AND EXCLUDE TEXAS? WHY MUST IT BE A STRAIGHT LINE?

I BELIEVE THAT FOR NOW WE SHOULD REDUCE THE SIZE OF THE REGION INVOLVED IN ANY CLEANUP PROGRAM, TO TAKE INTO ACCOUNT THE REMAINING QUESTIONS ABOUT LONG-RANGE TRANSPORT OF SULFATES. MY AMENDMENTS WOULD REMOVE THE NINE WESTERN AND SOUTHERN STATES MOST DISTANT FROM THE AREAS THAT HAVE SUFFERED DEMONSTRABLE DAMAGE FROM ACID RAIN; THESE STATES WOULD CONSTITUTE A SECONDARY REGION THAT COULD BE INCLUDED IN THE CLEANUP PROGRAM AT THE DISCRETION OF THE EPA ADMINISTRATOR.

I DO NOT CLAIM ANY PROFOUND SCIENTIFIC BASIS FOR MY PROPOSAL, EITHER. IT IS SIMPLY ANOTHER LINE ON A MAP. BUT

I WOULD SUGGEST THAT WE MUST HAVE A CLEARLY STATED RATIONALE FOR THE INCLUSION OF EVERY STATE IN THIS REGION BEFORE WE GO FORWARD. IT APPEARS CLEAR TO ME THAT THE CLOSER A STATE IS TO THE PROBLEM, THE MORE LIKELY IT IS TO BE CONTRIBUTING TO THE PROBLEM. TO IMPOSE THE PROFOUND ECONOMIC CONSEQUENCES OF THIS LEGISLATION ON ANY PARTICULAR STATE WITHOUT COMPELLING EVIDENCE OF COMMENSURATE BENEFITS WOULD BE IRRESPONSIBLE. IF MISSOURI, FOR EXAMPLE, IS FOUND TO BE CLEARLY CONTRIBUTING TO ECOLOGICAL DAMAGE 800 MILES AWAY IN THE ADIRONDACKS, FINE--COUNT US IN. BUT AS MISSOURIANS OFTEN DO, FIRST I MUST SAY, "SHOW ME."

LET ME ADD THAT SELF-INTEREST IS NOT THE ONLY REASON FOR THIS SUGGESTION. IF WE CONCENTRATE ON REDUCING POWER PLANT EMISSIONS THROUGHOUT A 31-STATE REGION, OVERLOOKING THE DISPROPORTIONATE CONTRIBUTION OF LOCAL SOURCES, WE RISK SERIOUS DISAPPOINTMENT. IF THE POWER PLANTS OF MISSOURI ARE NOT AFFECTING THE ADIRONDACKS, NEITHER WILL A CUTBACK AID THEM. THE RAINFALL MAY BECOME LESS ACIDIC IN OHIO--WITH LESS OF MISSOURI'S SULFUR IN IT--BUT OUR CENTRAL CONCERN IS NOT THE RAINFALL IN OHIO. A 50-PERCENT REDUCTION ACROSS THE BOARD MAY TRANSLATE INTO A CUT OF 20 PERCENT OR LESS FOR INDIVIDUAL LOCAL SOURCES THAT ARE DOING THE REAL DAMAGE.

MR. CHAIRMAN, YOU HAVE ALREADY HEARD MUCH ABOUT THE POTENTIAL COST OF A CLEANUP PROGRAM, AND I WILL NOT BELABOR

THE POINT. SUFFICE IT TO SAY THAT UNDER MOST SCENARIOS, MISSOURI ENDS UP CARRYING A BIGGER LOAD THAN ANY OTHER STATE INVOLVED. REGIONAL AND EVEN STATEWIDE ESTIMATES OF POTENTIAL RATE INCREASES MASK THE WIDELY VARYING EFFECTS THAT A CLEANUP PROGRAM WOULD HAVE ON INDIVIDUAL UTILITIES AND CONSUMERS. A REASONABLE, EVEN CONSERVATIVE, PROJECTION BY UNION ELECTRIC COMPANY IN ST. LOUIS RESULTED IN AN ESTIMATED 20 PERCENT INCREASE IN ELECTRIC RATES. THAT IS A STAGGERING FIGURE.

I BELIEVE WE SHOULD SPREAD THE COSTS OF COMPLIANCE EVENLY THROUGHOUT THE REGION. MY AMENDMENTS WOULD IMPOSE A SURCHARGE OF 3 MILS PER KILOWATT-HOUR--AT MOST A 5 PERCENT INCREASE IN RATES--ON ALL ELECTRICITY SOLD WITHIN THE REGION, REGARDLESS OF ITS SOURCE. STUDIES CONDUCTED BY THE CONGRESSIONAL RESEARCH SERVICE AND BY THE CONGRESSIONAL BUDGET OFFICE SINCE I PROPOSED THIS APPROACH IN S. 2594 CONFIRM THAT IT WOULD BE SUFFICIENT TO PAY FOR A MAJOR CLEANUP PROGRAM.

FINANCING THE PROGRAM IN THIS WAY ALSO WOULD TEND TO LESSEN THE DAMAGE DONE TO THE HIGH-SULFUR COAL INDUSTRY. IN ORDER TO CUT SULFUR EMISSIONS, A UTILITY MUST CHOOSE BETWEEN INSTALLING STACK-GAS SCRUBBERS AND SWITCHING TO LOW-SULFUR COAL. BY ELIMINATING THE NEED TO FINANCE THE LARGE CAPITAL COST OF SCRUBBERS, WE WOULD MAKE THAT OPTION MORE ATTRACTIVE--WITHOUT GOING SO FAR AS TO MANDATE IT, REGARDLESS OF ITS COST.

As a Senator from Missouri, I could never support a proposal that put all of the costs on my state for the benefit of another. If we are to solve serious and costly environmental problems like acid rain, the burden must be managed fairly--which is to say, in a politically acceptable way.

There is much talk in this debate about the principle of making the polluter pay. And that is fine in principle. But where utilities are involved, it will be the consumer that pays. It is not the fault of John Doe in Columbus, Ohio, or Springfield, Illinois, or St. Louis, Missouri, that he is hooked up to one utility and not another. He has no choice. He did not participate in the decision to burn high- or low-sulfur coal. He did not advise on the height of the smokestack or the configuration of the boilers or the need for precipitators. And he should not be held accountable for those decisions.

Nor should we be making artificial distinctions between different sources of electricity--between coal or oil or gas or nuclear. The point is to share the burden and go forward together to solve a common problem. We must not let regional divisiveness impede our progress toward that goal.

MR. CHAIRMAN, THE STATES OF THE NORTHEAST WANT THEIR RIVERS AND LAKES BROUGHT BACK TO LIFE. I AM A FISHERMAN, AND I SHARE THAT HOPE. I LOVE TO FISH IN MISSOURI, AND I WOULD LOVE TO FISH IN THE ADIRONDACKS, TOO. BUT LET US NOT DRIVE PEOPLE AND REGIONS APART WITH FINGER-POINTING AND NAME-CALLING. IF WE ARE TO MAINTAIN A NATIONAL CONSENSUS ON CLEANING UP THE ENVIRONMENT, LET US JOIN TOGETHER AS EQUAL PARTNERS TO GET THE JOB DONE.

129820.013 S.L.C.

AMENDMENT NO. ___ Calendar No. ___

Purpose: To amend the provisions relating to acid deposition.

IN THE SENATE OF THE UNITED STATES--98th Cong., 2d Sess.

S. 768

To amend the Clean Air Act.

Referred to the Committee on ________________________________ and ordered to be printed

Ordered to lie on the table and to be printed

Amendments intended to be proposed by Mr. Danforth

Viz:

On page 61, strike out lines 6 through 15 and insert in lieu thereof the following:

''Sec. 181. There is hereby established a long-range transport corridor, hereafter in this part referred to as the ''acid deposition impact region,'' consisting of the States of Connecticut, Delaware, Ilinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and the District of Columbia.

On page 66, strike out lines 1 through 9.

On page 66, line 10, strike out ''(i)'' and insert in lieu thereof ''(h)''.

On page 67, line 11, strike out ''8,000,000'' and insert in lieu thereof ''6,000,000''.

On page 70, line 19, strike out ''thirty-one''.

On page 71, line 14, strike out ''8,000,000'' and insert in lieu thereof ''6,000,000''.

On page 77, line 11, strike out the end quotation marks and the second period.

On page 77, between lines 11 and 12, insert the following:

''GRANTS FOR ACID DEPOSITION ABATEMENT; ACID DEPOSITION REDUCTION TRUST FUND

''Sec. 188. (a) The Administrator shall make grants to States in the acid deposition impact region from the Acid Deposition Reduction Fund (established under subsection (c)) for the purpose of assisting utilities in meeting the emission reduction requirements imposed by this part. All grants made under this section shall be used by such States to assist such utilities in meeting such requirements.

''(b) (1) The amount of the grant to each such State for each fiscal year shall be an amount which bears the same ratio to the amount available for such fiscal year in the Acid Deposition Reduction Trust Fund, as the actual net after tax expenses incurred by utilities in such State in meeting the emission reduction requirements of this part bears to the actual net after tax expenses incurred by utilities in all the States in the acid deposition impact region in meeting such emission reduction requirements; except that no grant to any State shall exceed 90 percent of the actual net after tax expenses incurred by utilities in such State in meeting such emission reduction requirements.

''(2) The Administrator shall by regulation determine the method for allocating net expenses incurred by utilities in meeting the emission reduction requirements of this part.

''(c) (1) There is established in the Treasury of the

United States a trust fund to be known as the 'Acid Deposition Reduction Trust Fund' (hereinafter in this part referred to as the 'Trust Fund'), consisting of such amounts as may be appropriated or transferred to such Trust Fund as provided in this section.

''(2) There are appropriated, out of any money in the Treasury not otherwise appropriated, to the Trust Fund amounts determined by the Secretary of the Treasury (hereinafter in this section referred to as the 'Secretary') to be equivalent to the total amount of the fees received in the Treasury under subsection (d) of this section.

''(3) Amounts in the Trust Fund shall be used only for the purpose of making grants under subsection (a) of this section to utilities required to reduce sulfur dioxide emissions under the provisions of this part.

''(4) The amounts appropriated by paragraph (2) shall be transferred at least monthly from the general fund of the Treasury to the Trust Fund on the basis of estimates made by the Secretary of the amounts referred to in such paragraph. Proper adjustments shall be made in the amount subsequently transferred to the extent prior estimates were in excess of or less than the amounts required to be transferred.

''(5) The Secretary shall be the trustee of the Trust Fund, and shall report to the Congress for each fiscal year, on the financial condition and the results of the operations of such Trust Fund during such fiscal year and on its expected condition and operations during the next five fiscal years.

''(6) It shall be the duty of the Secretary to invest such portion of the Trust Fund as is not, in his judgment, required to meet current withdrawals. Such investments shall be in public debt securities with maturities suitable for the needs of the Trust Fund and bearing interest at rates determined by the Secretary, taking into consideration current market yields on outstanding marketable obligations of the United States of comparable maturities. The income on such investments shall be credited to and form a part of such Trust Fund.

''(d) (1) There is imposed, on every utility which sells electricity in any State in the acid deposition impact region, an acid deposition reduction fee equal to 3.0 mil per kilowatt-hour on all electricity generated by such utility and sold after the date of the enactment of this part in any State in such region. Such fee shall be for the purpose of paying for the grants provided under subsection (a) of this section.

''(2) The fee imposed by paragraph (1) shall be collected by the person owning or operating the utility and shall be paid to the Treasury of the United States and deposited in the Acid Deposition Reduction Trust Fund.

''SECONDARY ACID DEPOSITION IMPACT REGION

''Sec. 189. (a) (1) There is established a secondary acid deposition impact region consisting of the States of Alabama, Arkansas, Florida, Georgia, Iowa, Louisiana, Mississippi, Missouri, and South Carolina.

''(2) If the Administrator determines, based on the results of the study conducted pursuant to section 182 (a), that the purposes of this part will be better served by including the group of States comprising the secondary acid deposition impact region in the acid deposition impact region established under section 181, he may include such group of States in the acid deposition impact region, effective on the date of such determination.

''(b) The provisions of this part shall apply to the States added to the acid deposition impact region by reason of subsection (a) in the same manner as such provisions apply to the States originally included in such region under section 181, except that--

''(1) all time requirements imposed under sections 183, 185, and 186 which are measured from the date of the enactment of this part, shall, with respect to such additional States, be measured instead from the date of the inclusion of such additional States;

''(2) the requirements of section 185 (b) (4) shall apply to such additional States effective 18 months after the inclusion of such additional States rather than on December 31, 1985; and

''(3) the Governors of such additional States may allocate the additional 2,000,000 tons of sulfur dioxide emission reductions among such additional States in accordance with the same requirements as set forth in section 184.

''(c) If the States in the secondary acid deposition impact area are added to the acid deposition impact area by reason of subsection (a), the term '6,000,000 tons' appearing in sections 183 (a) and 185 (a) (1) shall thereafter be deemed to be '8,000,000 tons'.''.

STATEMENT OF

HONORABLE JOHN H. SUNUNU, Ph.D., GOVERNOR

STATE OF NEW HAMPSHIRE

Before the

Committee on Environment and Public Works

United States Senate

Concerning
Acid Rain Legislation

February 7, 1984

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I appreciate the opportunity to appear here today to convey to you the concerns of the citizens of New Hampshire about the acid rain problem and express to you their desires that a long term program of emission reductions which will result in a 50% reduction in sulfur emissions be initiated as soon as possible. Mr. Chairman, my testimony today is based on my own background in energy and environmental matters and my recent experience as Chairman of the National Governors' Association (NGA) Acid Rain Task Force as well as the extensive work done by the New Hampshire Interagency Acid Rain Coordinating Committee and our Citizens Task Force on Acid Rain. I must make it clear, however, that I do not come before you as a representative of the NGA because my task force has completed its work and the matter is now before the NGA Executive Committee. I anticipate that acid rain policy will be on the agenda for our winter meeting which will be held here in Washington later this month.

Mr. Chairman, I am sure that Senator Humphrey and others have told you about the Acid Rain Conference which the New Hampshire Citizens Task Force on Acid Rain and others sponsored in Bedford, New Hampshire last month. The conference was distinguished by its organization as well as its substance and by its energy as well as its success. Senator Mitchell made a significant contribution as did many other national figures and experts. Over 500 participants from 27 states worked through a rigorous two and one half days of technical and policy sessions.

The conference adopted three resolutions at its closing session. Essentially, the first calls for a 50% reduction of sulfur emissions in the United States, the second calls for signing a treaty with Canada to that effect and the third recognizes that the acid rain issue is a bi-partisan issue. This last resolution was proposed by Mrs. Helen Black, who is a republican and from Ohio. It recognizes the efforts of many republicans who have worked hard on the issue. In addition to recognizing your work, Mr. Chairman, and the work of several others, it recognizes Senator Humphrey's efforts.

Mr. Chairman, with your permission, I would like to submit copies of these resolutions for the official record of this committee.

I would like to express my appreciation on behalf of the citizens of New Hampshire for this committee's focus on the issue rather than the politics and for its desire to get legislation into place. I would also like to express my personal appreciation to Senator Humphrey for his efforts. Many of us have gone through an evolution of thought on this issue over the last few years. Senator Humphrey has too; and, after carefully evaluating the information, has come to be very concerned about the problem and is working very hard at achieving a solution. We need this sort of careful evaluation and objective attention to all environmental issues from all quarters in order that real progress can be made.

Mr. Chairman, I thought it would be useful for me to share with you observations which are based on the various perspectives I've enjoyed over the recent past as well as on the evolving scientific data.

... First of all, the acid rain problem deals with a lot more than just environmental damage and sulfur oxide control, and it deals with a lot more than simply costs and benefits.

... It deals with inter-regional competition.

... It deals with jobs - not only jobs in the coal industry, but jobs in industries affected by higher electricity costs. That's why I believe that an acid rain reduction program should allow the maximum possible opportunity to allocate reduction targets within states and provide the maximum possible flexibility for sources in choosing their reduction strategy. I am convinced that this is the most cost effective approach. I am also convinced that this approach is not necessarily detrimental to either high or low sulfur coal in either the short or the long run.

... The problem deals with debates about the science of pollutant transport and the science of ecological damage as well. Some of this debate is good faith debate, but I'm afraid that much of it falls very short in substance. We need to understand that when we are dealing with subtle effects, the subtle biases of the investigators become significant factors in shaping their opinions. We should not be surprised that this situation exists because it exists in most environmental science debates. However, it is also important to emphasize that this characteristic does not suggest dishonesty in the science but rather it recognizes the humanness of the scientists.

... The problem deals with fairness. We must avoid penalizing those who have made reductions in the past by making them go through another round of reductions. Furthermore, to the greatest extent possible, we must avoid making them pay an unreasonable amount for reductions which need to be made in regions which still emit, for one reason or another, excessive amounts of sulfur. Simply stated, cost sharing and reduction formulae must give credit for past investments and reductions.

... Lastly, the problem deals with ingrained ways of doing business by the coal industry, the utility industry and by public utility regulators. In this regard, much of our task is simply educational. We need to show these sectors that change can hold the promise of a better economic and environmental future.

Based on the foregoing I suggest we need to keep the following precepts in mind while formulating plans for future actions.

... First: There clearly is a way to design an acid rain control program which treats all regions fairly and does not cause economic disruption or create excessive administrative burdens and costs. That program should rely on a free market response and we should have confidence in the results of that response. A phased program not only allows for mid-course corrections based on environmental trends, it also allows for a response to market distortions if they occur. Therefore, I believe that a committment to overall reduction goals while allowing a two phased reduction program is essential if legislation is to succeed.

... Second: The high sulfur coal industry and its workers need to understand that high sulfur coal may be in trouble in any event, and an acid rain program will do little to alter that reality. In fact, it may well be that high sulfur coal needs a national acid rain program in order to survive!! In any event, we need to let them know that we do care about their futures and that there is a way to devise a program which gives both high and low sulfur coal a fair shot at present and future markets. Mr. Chairman we've experienced economic dislocation in New Hampshire in the past and we understand the problems. People clearly can't be treated as bland statistics.

... Third: We've got to be concerned about a wide range of jobs - - jobs ranging from those in tourism and the farm and forest industries to those jobs which depend on reasonably priced electric power. To focus only on coal jobs would be unwise. Furthermore, jobs will be created in the steel industry, the construction industry, and in engineering and design by an acid rain reduction program. We can't overlook these.

... Fourth: We must avoid "freezing in" today's technology for a program which will take more than a decade to implement. If we do our job right, we can develop a program which will encourage the use of more cost effective and rapidly evolving technology as time goes on. That is another reason why I believe that we need a phased program to do the job most effectively.

... Fifth: There is a limit to our patience. We've tried to be reasonable with the midwest. But, we cannot continue to try to develop a program which will respond narrowly to the desires of the mid-west and its high sulfur coal industry - which has refused to accept virtually any program at all - while ignoring the interests of those in the upper midwest, far-west and south which are much closer to our own and who are much more supportive about embarking on a reasonable program.

... Sixth: We've got to realize that much more is being demanded of science than science is able to deliver, should be asked to deliver, or is being required to deliver in the case of other national issues. Science will never absolutely prove prospective issues to everyone's satisfaction. If it could, the tobacco industry would no longer be arguing about the connection between smoking and cancer. In addition to the bias problem which I raised earlier there is the problem that future basic research could highlight the divisions between the factions and opinions which exist now rather than settling any of the basic differences which those opposed to action will continue to raise.

The acidification process within watersheds is a good example. There is sure to be a flurry of debate about the role of natural acidification processes and papers will be written which, when taken in narrow context, will indicate that acid precipitation does little to alter this natural process. This idea has been rebutted time and time again. The facts are, that in the preponderence of northeastern watersheds, more than 50% of the acidity is contributed by precipitation, that natural acids cause different impacts from those of acids from acid precipitation and that local pH has more influence on the final outcome than total acidity does. Simply stated, further research will do little to change regional minds. In fact, more research, unless applied to burner technology or source/receptor relationships, - those key requirements for achieving a meaningful reduction program - will probably shed more heat than light on our existing knowledge.

I am convinced that we have enough scientific data regarding the causes and effects of acid rain to enable us to make the political decision to move on to a solution. Furthermore, when that decision is made, science can provide the tools we need to get the job done right. That is why a program of increased research ought to be part of a long term reduction program and schedule. The reduction program and reduction schedule is required to give direction and a feeling of immediacy to government sponsored research as well as give clear signals regarding policy direction to the utilities and the coal industry. It is time to settle the issue and get on with it.

Throughout the debate we must constantly remind ourselves and others that the chronic long-term effects - the effects which are most difficult to identify now - are a serious matter which deal with human health, visibility and materials damage as well as ecological effects.

Finally, we've got to recognize the magnitude of the numbers involved. On the one hand, many sectors are over reacting and predicting adverse economic effects which are well beyond realty. On the other hand, we've got to remember that the utility industry is a huge industry. The nation's total electric bill is about 120 billion dollars per year. The utility industry will spend more than 30 billion dollars next year alone on capital improvements. In this context a program which has an annualized cost in the range of a few billion dollars per year does not look so large. In fact, one could look at the relationship of these numbers and ask what the fuss is all about.

Mr. Chairman, if we lived in a perfect world, I could support your bills without reservation. However, I have the feeling that a final national consensus may have at least some of the features of the staff draft now under consideration by the NGA Executive Committee, which, I might add, is quite similar to the final detailed draft which was under consideration by my task force.

Having said that, Mr. Chairman, I must also add that you know the business of the Senate better than I. We need a bill. We need to have legislation in place as soon as possible. On behalf of the citizens of New Hampshire, I applaud your efforts to report a bill out and wish you and your Committee well in this endeavor.

TESTIMONY PREPARED FOR
GOVERNOR SCOTT M. MATHESON
TO THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE
ON LEGISLATION TO CONTROL ACID RAIN
FEBRUARY 7, 1984
WASHINGTON, D.C.

[Introductory Remarks]

Chairman Stafford, members of the Senate Environment and Public Works Committee, I am very pleased with the opportunity to meet with you today to discuss legislative approaches to the problem of acid rain. It is an honor to appear with my fellow governors from New Hampshire and Minnesota and I am particularly pleased to be sharing this forum with Governor Ted Schwinden from Montana. I have had the opportunity to work closely with Governor Schwinden on many issues, including clean air, and I think that you'll find that our concerns and recommendations to you are similar.

My remarks today reflect considerable background and thought on acid rain legislation and the Clean Air Act. Since 1980, I have served as the lead governor for the Western Governors' Policy Office (WESTPO) on clean air issues, I was one of two western representatives on the National Governors' Association Acid Rain Task Force and I have been a member of NGA's Energy and Environment Committee for seven years.

In 1981, the western governors, acting as WESTPO, developed a comprehensive policy on the reauthorization of the Clean Air Act. We noted the emerging problem of acid rain and asked that "initial steps to reduce sulfur oxide and nitrogen oxide emissions, including an emissions reduction program for major existing fuel burning sources, should be aimed at the most cost-effective methods and obvious sources."

In 1983, it became clear that our simple statement of purpose was not sufficient to respond to the complex environmental and economic issues involved in the acid rain debate. In August of 1983, we adopted a detailed western statement on acid rain legislation which has been delivered earlier to Committee members. My remarks today will expand upon that policy statement and provide some specific recommendations which we hope will be included in any acid rain legislation.

A few of the eastern members of the Committee may be surprised that western governors are sympathetic to their concerns about acid rain damage. In Utah, and across the West, we are proud of our shared tradition of environmental concern and we place a high value on our resources of clean air and clear skies. While we are not directly affected by acid rain, or acid rain legislation, Utah citizens and westerners share a concern for eastern lakes and forests in much the same way that people in New England or the Midwest value the scenic views, wide open spaces and wildlife of the West.

There is little difference I believe, in the way our citizens view the acid rain issue. Unfortunately, the debate extends beyond the issues of clean water and clear skies. The question which has pitted the various regions and industries of this country against one another is not an environmental issue at all, but a raging battle over economics. The questions of timing, scale and structure of an acid rain control program are major economic questions. Thus, while many governors support immediate Congressional action to solve the environmental problem, we may differ in our approach to some of these economic questions. The WESTPO policy advocates an emission reduction program based upon environmental needs, not economic wishes. But the decision to support acid rain legislation which is economically neutral is, in itself, a decision with important economic consequences.

We believe that the Congress should adopt acid rain control legislation which includes five key components:

Cost-effective Reductions

First, federal legislation should encourage the most cost-effective emission reductions. Specifically, we would strongly object to any legislation which would mandate specific technological controls or prohibit the use of cleaner fuels to achieve emission reductions.

High sulfur coal interests argue that an acid rain control program should include specific legislative provisions to maintain production and employment in the high sulfur coal fields. Often these demands extend not only to existing miners and their jobs, but to future jobs and markets as well.

I am sympathetic to concerns of unemployment and dislocation in the nation's coal fields. The 1982-1983 recession, coupled with declining oil prices, has delivered a crushing blow to the coal industry in my state. In Utah, we have 22 coal mines. In December of 1983, 11 of those mines were closed and 7 had reduced operations. Utah coal production in 1983 dropped 35% from our record 1982 production and we will be lucky if 1984 production matches last year's depressed figure. The human picture painted by these figures is even more bleak. Coal mining employment in Utah has dropped 40% since 1982. Men with 15, 20 even 30 years of seniority lost their jobs as declining production drove second and third-generation miners from their jobs, their homes and even from their hometowns as they were forced to leave Utah's coal country looking for work. Unemployment in our major coal producing county reached nearly 20% in 1983, and even though the state is recovering from the recession, unemployment in that county is still double the statewide average.

As a governor, I have first-hand experience with coal mine unemployment and dislocation, and I am a strong advocate of legislation providing extended unemployment benefits, job retraining and job relocation. Yet I cannot support a program that, for the sake of coal mine jobs in Utah or any state, would dramatically increase the cost of the acid rain control program, distort economic choices of utilities, and drain billions of dollars of capital from more productive uses. Unfortunately, the coal industry -- east and west, high and low sulfur -- has a long history of boom and bust, and frankly, there are no Clean Air Act changes which will solve that problem. Proposals which seek to insulate some portions of the coal industry from market forces, at the expense of the nation's utility customers, seem doomed to expensive failure.

The Washington Post, in an editorial that has become very popular in the West, states simply that "The rule for EPA to propose, and Congress to adopt, is a sharp reduction in power plant emissions -- but one that leaves it up to each company to figure out the best and most efficient way to achieve it." I agree. The loss of coal mining jobs, an important regional and national issue, is not appropriately addressed by amending the Clean Air Act. I would support, as would many other western governors, appropriate legislation to mitigate actual job losses associated with acid rain controls, or other environmental measures. Those programs should be targeted at job losses as they occur, not at "potential" or "projected" impacts. We have reviewed projections of coal production shifts caused by acid rain controls and suspect that they usually overstate actual impacts. Shifts in production from east to west, easily accomplished by computer models, are not so easy in the real world of increasing transportation rates, permitting and start-up time of new mines and other environmental factors which may place short-term limits on western low sulfur production. I also suspect that states and utilities, given an emission reductions mandate and an incentive to hold down control costs, will probably find innovative methods, which involve neither fuel switching or scrubbing, to achieve that goal, further limiting dislocation in coal markets.

State Implementation

Second, the policy adopted by the western governors asks that states be given the primary responsibility to implement emission reductions. Legislation should allow states to select any reduction measures they desire, including, but not limited to: early retirement of sources, cost-effective retrofits energy conservation investments, fuel switching and pre-combustion cleaning of fuels.

The Clean Air Act has traditionally relied upon a clear division of responsibilities between states and the federal government. We see no reason to depart from that approach to control acid rain. Proposals that would require controls on certain power plants, or proscribe individual state emission reduction strategies will add unnecessary costs and may in fact be counterproductive, as they overlook quick and easy reduction opportunities which the state implementation plan process is designed to identify. Western governors have also suggested changes in the State Implementation Plan approval process which would speed SIP approval -- most of those changes were adopted by this committee in a bill approved last session and should be included in any reauthorization of the Clean Air Act to enhance that portion of the acid rain program.

Nationwide cost-sharing

Third, the governors object to any legislation which imposes nationwide costs while providing only regional benefits. Specifically, we object to cost-sharing schemes which would tax utility customers in western states to finance control measures in other regions. In many parts of the country, especially the West, citizens have already invested in emission controls. In the western region, 31 percent of our coal-fired capacity currently uses scrubbers to control sulfur dioxide emissions; only 7 percent of the capacity in the eastern region is scrubbed. Western emission controls are also imposed on much cleaner coal -- in the West, the average sulfur content of utility coal is 0.64 percent, while eastern utilities burn coal which averages 2 percent sulfur.

Utah citizens have made dramatic investments in power plant scrubbers -- the average emission rate from utility boilers in Utah is .38 lb of sulfur per million Btus and that rate is declining as cleaner sources come into operation. During the past few years, the Utah Bureau of Air Quality has issued permits to two major coal fired power plants. The first, the Intermountain Power Project, will burn coal that is less than 1% percent sulfur, remove 90% of the sulfur dioxide emissions through scrubbers and has a permitted emission rate of .15 lb. per million Btu's. The air quality controls associated with the IPP plant will cost over $308 million -- more than 20% of the total capital cost of the plant. The Bonanza power plant, in eastern Utah, will install control technology to remove 94% of the sulfur dioxide, and has been permitted at an emission rate of .055 lb. per million Btu's -- no cleaner power plant has been permitted anywhere in the country. Controls for the 400 MW plant will cost $155 million, 22 percent of the total capital cost of the plant.

These costs are significant, and are reflected in rising electric rates, but we do not object to paying the price for clean Utah air. State regulations require a minimum of 90% sulfur removal on new coal-fired boilers (which is 20% higher than current New Source Performance Standards) and place a limit on the sulfur content of coal which can be burned. We must make this investment to preserve our air quality resource and to ensure that air quality increments will be available for future growth. While we are paying the cost of our own controls, I believe that Utah citizens will object to schemes which tax their electricity to pay for controls in states which have been unwilling to assume that burden. Nationwide cost-sharing schemes have the perverse effect of punishing those who have invested in clean air and rewarding those who have lagged behind, subsidizing their own power rates by exporting pollution.

Regional Differences

Western governors also hope that any acid rain control legislation will recognize regional differences in size and type of emissions, climate and topography. It would be wrong to impose additional emission reductions in the West, based upon data limited to studies in the east and midwest. Some schemes would extend acid rain controls to 48 states, in the interest of "fairness". We believe that policy to be counterproductive, as it would dilute the impact of the reductions on the region currently affected by acid rain, and unfair, because emission reductions will be so hard to find in the West. While the 13 WESTPO states produce nearly 13 percent of the nation's electricity, we produce only 4 percent of the nation's utility sulfur emissions and less than 1 percent (0.62%) of the nation's utility sulfur emission above current New Source Performance Standards (1.2 lb. sulfur/million Btu). The combined utility sulfur emissions from the WESTPO states (stretching from Nevada to Nebraska) are less than the individual emissions from 10 southern and midwestern states. Our combined utility emissions are less than a third of those produced by the state of Ohio alone, and about equal to the SO_2 emissions of Florida, and Ohio produces fully 100 times the amount of utility sulfur dioxide that is produced in Utah. Furthermore, current provisions of the Clean Air Act and State Implementation Plans which control copper smelters and mobile sources, have resulted, and will to continue to result, in declining emission levels during the next few decades.

While we would oppose the extension of emission reductions into our region based on political or economic reasons, the governors are concerned about the potential for future damage to western watersheds from acid precipitation. Our policy asks for Congressional action directing EPA to initiate cooperative studies with the states to address long-range transport issues in the high and complex terrain of the western region. We are also beginning, through research programs at western universities and with western industries, to identify potentially sensitive areas and to monitor precipitation. For example, a Utah program is just beginning to monitor the acidity of precipitation and stream flow in the Wasatch Mountains, east of Salt Lake City and in the High Uintas, a major watershed for the Colorado River drainage. Long-range transport in the unique climate and topography of the West is much ignored, though it relates to some important clean air issues, including visibility protection and potential acid deposition. We hope that this committee will support our call for careful studies.

Best Available Control Technology

Finally, the governors recommend that any reauthorization of the Clean Air Act minimize the emissions from new sources throughout the country through the continued application of Best Available Control Technology (BACT). We feel that the BACT provisions of current law are the best insurance against future environmental problems. As long as states diligently enforce the requirement -- and again, you will find that western states are the leaders in BACT decisions -- we have made our best effort to avoid future air quality problems.

Proposed Legislation

I realize that many of the recommendations which I have made today were adopted by this committee last session as you reported out amendments to the Clean Air Act. I urge you today to remain committed to the principles contained in that legislation and to resist pressure to distort the acid rain control program to eliminate threats of economic disruption. Our history with the Clean Air Act teaches that when we try to mix economic and environmental policy, we frequently create laws which are bad for the environment and bad for our economies.

S. 768

I understand that the legislation which the committee approved last year is currently being considered as S. 768. While I do have some concerns about other provisions of that bill, I am prepared to support the acid rain portion of S. 768 with some important amendments. These comments also apply to S. 769, which is a simplified version of S. 768 and may therefore, be a preferable vehicle. On the most important difference between the two bills -- the actual emission reduction required -- I do not feel qualified to speak, though I will have some comments about the phasing of those reductions.

First, I would suggest that the committee clarify the language of Section 187 regarding enforceable emission reduction programs. While the language appears to allow states full flexibility in attaining emission reduction, the absence of fuel switching from the specified list of enforceable emission reductions creates some ambiguity. This is especially important since other proposed legislation does list fuel switching as an emission reduction measure and the absence in this bill might be interpreted as deliberate. Section 187(a) should be amended by adding at the end "(6) fuel switching."

Second, I have some concerns about the regional emissions cap established in Section 183. While my state would not be directly affected, I believe that emission caps are generally bad policy as they are not flexible enough to respond to changing circumstances and conditions. Inflexible emission caps are more appropriately used where clean air standards are violated, in nonattainment areas, for example. Other provisions, including the prevention of significant deterioration program and Best Available Control Technology requirement should be sufficient to minimize emissions from new sources.

My most serious concern is reserved for Section 121 of S. 768, (Interstate Pollution) which is not a part of the acid rain section of the bill, but which, in amending current provisions of law regarding interstate pollution, is directly related to it. The language of Section 121(a)(3) and 121(c)(1) is much too broad for a statute which endures as much judicial scrutiny as the Clean Air Act. As a governor and an attorney, I fear that the language could lead to incredible mischief, and if litigation is misused, could even delay implementation of acid rain controls.

These three changes are important, and would insure my support of S. 768, or S. 769. I would however, suggest some other changes which might improve the acid rain legislation.

Both bills make some attempts to phase in the required reductions by encouraging early reductions and, in the case of S. 769, requiring some portion of the reductions by 1993. I suggest that the committee consider a more explicit phasing of the program. Most studies show that a moderate sulfur dioxide emission reduction program of 5 to 7 million tons could be achieved in a relatively short time frame (5 to 8 years) at relatively low costs. Additional reductions are more difficult and more expensive. Legislation which required a smaller, short-term reduction as part of an overall emission reduction strategy could result in lower long-term total emissions and would allow the Congress and the EPA Administrator to review the early results of those reductions before moving on to the more expensive second phase. That additional time may allow for a more effective targeting of emission controls in the second phase. Finally, a more distinct phasing allows time for development of new control technologies which may provide future reductions at lower costs and with less economic disruption than our current list of options.

I also urge the committee not to move forward with acid rain legislation apart from a comprehensive reauthorization of the Clean Air Act. The acid rain debate is important, but I fear that it has diverted our attention from some other pressing issues, including streamlining some of the state implementation plan review procedures and adding some flexibility to the PSD program. These other important Clean Air Act issues should not be forgotten in a rush to action on acid rain.

Conclusion

I appreciate the invitation to appear before this committee. I have been involved in many discussions of acid rain legislation among the governors and I do not envy your responsibility to sort these problems out and proceed with legislation which will fairly and quickly respond to a growing environmental problem. I hope that my comments have been constructive and offer the assistance of my office and of the Western Governors' Policy Office to provide any additional information which you might find helpful. I wish you good luck and would be pleased to answer any questions.

Thank you.

August 20, 1983

Bismarck, North Dakota

Sponsors: Governors Matheson, Herschler
Subject: Clean Air Policy -- Acid Deposition

A. Background

In September of 1980, the members of the Western Governors' Policy Office committed "to play a full and constructive role in congressional proceedings dealing with the Clean Air Act." In May of 1981, the Governors, after a thorough review of clean air issues from a western perspective, adopted a policy statement on the Clean Air Act which addressed five areas: federal and state roles, prevention of significant deterioration, visibility, non-attainment areas and long-range transport and interstate cooperation. This position was amended in July, 1982 to include a position on formulation of New Source Performance Standards (NSPS) which supports maximum flexibility in meeting emissions standards, including the use of low-sulfur fuels or innovative technologies.

The WESTPO policy recognizes the need for a program to control acid rain and states: "In order to deal with the particular problem of acid rain, initial steps to reduce sulfur oxide and nitrogen oxide emissions, including an emissions reduction program for major existing fuel burning sources, should be aimed at the most cost-effective methods and obvious sources. To provide a better information base and reflect the effects of acid rain, there should be expanded ambient acid deposition monitoring using standardized methods of sampling and analysis."

The policy recommendations adopted here reaffirm the substance of our 1981 statement, but also recognize that the body of scientific evidence in support of an emission reductions program continues to grow. During recent months, several important acid rain studies have been completed. Most significantly, the National Academy of Sciences concluded that there is a direct relationship between SO_2 and NO_x emissions and acid deposition. These studies have been limited almost exclusively to the midwest and northeast regions of the country. They have not addressed the unique climate and terrain of the western states and the conclusions of these studies are not applicable across the nation.

At the same time, the Congressional debate has begun to focus on some key acid rain issues: the size of the program, financing and the method of emissions reductions. Legislation introduced last month would extend the acid rain control program to 48 states, impose a nationwide utility fee to finance the program and eliminate the possibility of switching to low sulfur fuels to achieve emission reductions. This legislation ignores scientific and economic realities. According to 1980 data, emissions from WESTPO states represented only 4.4% of the nation's utility emissions, and many western sources are already fully controlled. Any contributions made by western sources to an acid rain problem have not yet been identified or understood. Further, the Office of Technology Assessment concluded in 1982 that various scrubbing technologies are up to three times as costly as fuel switching in achieving similar SO_2 reductions. Finally, 48-state legislation would force western utility ratepayers, who in many cases are already paying for technological emission controls on western power plants, to finance those same controls across the nation, primarily to limit the marketing opportunities for western low sulfur coal. OTA has estimated that legislating technological controls will reduce potential western coal production by more than 14 million tons annually, while imposing significantly higher costs.

B. Governors' Policy Statement

Western Governors are sensitive to the environmental damage caused by acid rain and are particularly concerned about the potential for future problems in western states. We are not opposed to making a contribution toward the solution of an important national problem, but we must oppose legislative proosals which impose significant direct and indirect costs on western states, while providing no benefits to our citizens.

Within a comprehensive reauthorization of the Clean Air Act, the Congress should adopt an acid rain control program which:

1. Encourages the most cost-effective emissions reductions. Legislation should not mandate technological controls or prohibit the use of cleaner fuels to achieve reductions in emissions.

2. Relies primarily on states to implement emission reductions. Legislation should allow states to select any reduction measures they desire including, but not limited to: early retirement of sources, cost-effective retrofits, energy conservation investments, fuel switching and precombustion cleaning of fuels.

3. Does not impose nationwide costs while providing only regional benefits. An acid rain control program which imposes costs on all regions must also provide some direct benefits to all regions. In several regions of the country, including the west, citizens have already made a significant investment in emission controls. Acid rain legislation should not reward

inaction. Similarly, in any funding plan, credit should be given to sources of electricity, like hydroelectric power, which are non-polluting.

4. Recognizes regional differences in size and type of emissions, climate and topography. Congress should not impose additional emission reductions in the West based on data that is limited to existing studies of the east and midwest. Under current provisions of the Clean Air Act, which the Governors support, emission levels of SO_2 and NO_x in the West will decline. In the meantime, Congress should direct EPA to immediately initiate cooperative studies with the states, addressing the long-range transport of pollutants in the high and complex terrain of the western region. Such studies should be completed within four years and should form the basis for any necessary legislative action.

5. Minimizes emissions from new sources throughout the country through the application of Best Available Control Technology and revision of new source performance standards where appropriate.

C. Governors' Management Directive

1. Present this statement to the Congressional members from WESTPO states and to other appropriate Congressional leaders. Present this position in Congressional hearings on reauthorization of the Clean Air Act.

2. Present this statement to the President, the Administrator of the Environmental Protection Agency and members of the Cabinet Council on Natural Resources and the Environment, requesting that western concerns be considered in the formulation of the Administration's acid rain policy.

3. Staff will conduct an ongoing review and assessment of studies on acid deposition and long range transport of pollutants in the WESTPO states in order to provide the governors and the Air Quality Steering Committee with a more thorough understanding of these processes.

4. The WESTPO staff and the Air Quality Steering Committee will work with other states and other western interests to advance common goals and objectives of this policy.

Adopted August 20, 1983.

Testimony of

THE HONORABLE
RUDY PERPICH

GOVERNOR

STATE OF MINNESOTA

before the

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
HEARING ON ACID RAIN

February 7, 1984

Good Morning, Mr. Chairman and members of the committee, I want to thank you for this opportunity to provide the committee with the State of Minnesota's views and concerns regarding acid deposition control legislation. Senator Stafford, I am very pleased that you have taken a leading role on acid deposition legislation in the United States Senate.

Although my comments today represent Minnesota's concerns about acid deposition, those concerns are also shared by our neighbors in Wisconsin and Michigan. These three states all have thousands of lakes, miles of streams, and vast acres of forests that are sensitive to acid deposition, as well as important industries that depend on the long-term health and well-being of those resources. Minnesota has something else in common with Wisconsin and Michigan - regardless what actions we take to reduce acid rain emissions within our own borders, we can not stop acid rain ourselves. Acid rain is a national problem requiring a national solution.

As you know, acid deposition is of great concern to Minnesotans. Due to the glacial and geologic history of Minnesota, much of northern and eastern Minnesota is sensitive to acid deposition. As the glaciers passed back and forth over Minnesota, they left thousands of lakes. But the glaciers, through their scouring action, also left very thin soils and exposed bedrock, both of which have low capacities to neutralize acid deposition.

Our studies at the Minnesota Pollution Control Agency (MPCA) and the Department of Natural Resources have resulted in a data base that is second to none. We have learned that about 3,500,000 acres of forest soils in Minnesota are sensitive or potentially sensitive to acid deposition. That represents about 19% of the forested land in Minnesota.

Although Minnesota is known as the land of 10,000 lakes, we really have more than 12,000 lakes larger than 10 acres. Of those, the MPCA estimates that between 1,500 and 2,500 lakes are sensitive to acid deposition. That represents about 25% of the lakes in the state that are classified as fishing lakes.

In addition to our concerns about lakes and forests, MPCA estimates that 1,200,000 acres of peatlands in Minnesota may be affected by acid deposition. Some of these sensitive peatlands represent a unique wilderness of wildlife and vegetation that cannot be found in any other state outside of Alaska.

Altogether, we believe that about 15% or almost 8,000,000 acres of Minnesota's forests, peatlands, and watersheds are sensitive to acid deposition. These areas cover much of eastern and northeastern Minnesota and include Voyaguers National Park, the Superior National Forest, the 1,000,000 acre Boundary Waters Canoe Area Wilderness (BWCA) and even include some park and forested areas in the Twin Cities.

Agriculture, tourism, and forestry are the three largest industries in Minnesota. Two of these industries, tourism and forestry, are seriously threatened by acid rain. Agriculture, though not currently threatened, could be affected if rainfall becomes more acidic in the future. The long-term vitality of our forestry industry is threatened by slow degradation of forest soils. As far as tourism is concerned, one study shows that the first signs of lake acidification in the BWCA could result in an annual loss of about $40,000,000 per year and 3,000 jobs. That represents only a fraction of the total tourism and sport fishing industry in Minnesota. We are very proud of our beautiful environment in Minnesota; the many lakes, the forests, Voyaguers National Park, and the Boundary Waters Canoe Area wilderness. So acid deposition is an economic, environmental, and emotional issue to our state.

According to the MPCA, rainfall in Minnesota ranges from well-buffered rain in western and southwestern Minnesota to highly acidic rain with pH's in the low 4.0's in the extreme northeastern part of the state. Unfortunately, the rain is most acidic in the areas that are most sensitive. So far, there are no dead lakes in Minnesota. However, based on the Scandinavian experience, the acidity of precipitation and the rate of deposition in northeastern Minnesota is already great enough to begin causing subtle chemical changes in our most sensitive resources. MPCA's computer modelling shows that 20% to 30% of the acid deposition falling in Minnesota comes from sources within the state. Another 20% or so comes from Canadian sources, primarily smelters in Ontario and Manitoba. The remaining 50% comes from other states. The other states contributing to acid deposition in Minnesota include our neighboring states to the west, east, and the south. North Dakota, Wisconsin, Missouri, western Illinois, and Canada are likely the largest out-of-state contributors.

Minnesotans recognized that our own emissions contribute significantly to acid deposition in our state. As a result of environmental concerns and the responsible action of the utility industry, emissions of sulfur dioxide in Minnesota are much lower today than ten years ago. Since 1974, we have reduced SO_2 emissions by over 30%, to a point where our major power plants and industrial sources emit at a statewide average of 1.5 pounds of SO_2 per million BTU. We intend to reduce emissions even further. In 1982, the state legislature passed a bill known as the Minnesota Acid Deposition Control Act. This establishes Minnesota as the first state to begin regulating acid deposition. As a result of that Act, we have developed a comprehensive inventory of sensitive resources. We are now in the process of developing a formal acid deposition standard to protect those resources. By January 1, 1986, we will have developed a control plan to meet the standard, and our sources must be in compliance by 1990.

Even though the Acid Deposition Control Act sets a rigid schedule for reductions by establishing a 1990 compliance date, we have already begun reducing emissions in Minnesota. Northern States Power Company (NSP), at the MPCA's request, has agreed to reduce emissions at three of its existing power plants in order to offset emission growth that is likely to result from the construction and operation of a new coal-fired power plant which is currently under construction. This action demonstrates how we can reduce emissions and, at the same time, accommodate future growth.

As far as federal action is concerned, Minnesotans are frustrated with the sluggish reactions of Congress and the federal government. We are naturally concerned that any federal legislation address acid deposition in such a manner that will ensure adequate protection for Minnesota's sensitive resources. The steps necessary to control acid deposition in Minnesota are similar but at the same time, geographically different than those necessary to control acid deposition in New England and New York. This is because the sources that contribute the most to acid deposition in Minnesota are different than the sources that contribute the most to deposition in New England. Different sources contribute to acid deposition in the Western states and in the Southeastern states as well.

I have been actively working within the National Governors' Association (NGA) to help formulate an environmentally sound acid deposition policy that is not regionally devisive. This has not been an easy task. Many areas of the country such as the Midwest feel that acid rain legislation will only cost them and that the benefits will be realized only in remote lakes in New England, or Minnesota.

We must all remember that the sensitive lakes and forests we seek to protect are a national resource as well as a local resource. And we must not forget the other benefits that will result in reducing acid forming emmissions - benefits that will occur closer to the pollution sources: cleaner, healthier air to breathe; more productive crops; reduced materials corrosion; and increased visibility.

When we balance the costs of control against the value of all the benefits, our generation and future generations will find that controlling acid rain now is both environmentally and economically the sensible thing to do.

Now I would like to offer my views relating to the specific goals that should be encompassed by comprehensive national legislation.

First, as I already suggested, acid rain is a national problem requiring a national solution. Sensitive resources exist throughout the country and sources of sulfur dioxide can be found in every state. Therefore, every state should have protection from acid deposition and every states' sources should be considered for control.

Second, to adequately protect sensitive resources in the United States and Canada, a reduction in sulfur dioxide emissions on the order of 50% is warranted. This represents a reduction of 10,000,000 to 12,000,000 tons/year in the United States. Emission reductions can be allocated in a number of ways. The method of allocation should take into consideration existing emission levels and emission rates, as does the formula in

S. 768, so as to credit states that already employ emission controls.

Third, to address acid deposition on the west coast, the committee may wish to consider nitrogen oxide emission reductions. Such reductions can be accomplished through new emission standards on power plants and trucks.

Fourth, for continued protection from acid rain, new emission sources and increased emissions from existing sources must be offset. We need to ensure that the 50% reduction is not eroded in the future.

Fifth, strengthening language must be added to the existing provisions for interstate transport of pollutants in the Clean Air Act, especially if control legislation is limited to a particular region of the country. The current interstate transport provisions do not recognize acid deposition as a form of pollution. Sections 110 and 126 must be strengthened to ensure that one state is prevented from emitting air pollution which could endanger public health or welfare in another state, regardless of violations of ambient standards. The interstate provisions in S. 768 address this issue very well in my view.

Finally, I would like to comment on the concept of a funding mechanism for the purpose of assisting in mitigating the costs of complying with a control act. Most current federal legislation that controls air and water pollution revolves around the concept that the polluter should bear the cost of pollution control. Ideally, that concept should work for acid deposition as well. Therefore, we prefer no funding mechanism for acid deposition control.

However, we also recognize the necessity of developing legislation that is politically acceptable to Congress in order to achieve our goal of mitigating acid deposition in a timely manner. A funding mechanism may indeed be necessary in order to meet that goal. My experience on this issue with the National Governors' Association has made it clear that many regions of the country feel very strongly about the need for a funding mechanism.

Various funding mechanisms have been proposed by Congressmen, Senators, and Governors. If some type of a funding mechanism is to be added, we prefer one that recognizes, to some extent, the existing degree of pollution control in a state. However, the most important issue to Minnesotans is reducing acid deposition. Therefore, we support whatever reasonable type of funding is required to move legislation through Congress. The benefits of controlling acid deposition will more than offset the costs of funding the reductions of sulfur dioxide emissions.

We believe strong acid rain legislation must be passed by Congress in 1984. Minnesotans support and appreciate your efforts to help solve this critical environmental problem.

Again, thank you for the opportunity to discuss this important issue. Sandra S. Gardebring, Executive Director of the Pollution Control Agency is here with me today, and together we would be happy to answer any questions you may have. Good luck in your efforts to pass acid legislation in this Congress.

State of Montana
Office of the Governor
Helena, Montana 59620

TED SCHWINDEN
GOVERNOR

TESTIMONY BY MONTANA GOVERNOR TED SCHWINDEN BEFORE THE U.S. SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE ON LEGISLATION TO CONTROL ACID RAIN

TUESDAY, FEBRUARY 7, 1984, AT 10:00 A.M. IN
WASHINGTON, D.C.

Mr. Chairman and members of the Committee, I want to thank you for this opportunity to testify on one of our nation's most pressing environmental challenges.

I hope my testimony will give you a broader sense of the western perspective on acid rain. While I carry no formal mandate to present a regional viewpoint, I consider my comments representative of the attitudes of Montanans and their neighbors in the West.

The people of Montana and the West approach the acid rain debate from the perspective of concerned environmentalists. The western states have demonstrated a level of commitment to environmental cleanup at the state level which, if matched nationwide, would make federal acid rain legislation unnecessary. In Montana, we not only enjoy the environmental benefits of using our abundant supplies of low-sulfur coal, we also require our coal-generated power plants to install scrubbers to clean their emissions even more.

Our investment in air pollution control is rooted in our belief that clean air is one of the special qualities of western life. Montana's Big Sky would shrink considerably if we allowed the levels of pollution that are taken for granted in the East.

Montana has made a substantial financial commitment to clean air. The requirements of clean air technology have cost one Montana utility $500 million for capital construction since 1978, amounting to 35 percent of the total capital costs for the construction of two new coal-fired generating plants. That environmental cost, borne by Montana consumers, represents 30 percent of the current average retail price of residential electricity --- an estimated 13 mill-per-kilowatt-hour increase in electrical rates. So Montana can sympathize with all sides in the acid rain debate. We understand the importance of environmental cleanup; we also have an appreciation for its costs.

Committee members from New England have our special sympathy. Assaulted by acid rain that does not respect state or regional boundaries, your citizens have no choice. They must rely on federal laws and regulations to address a problem that threatens their environment daily. Montanans are convinced that low-sulfur coal can help solve that problem if those federal laws and regulations are revised accordingly.

In our judgment the Committee should adopt acid rain legislation similar to the program it endorsed in 1982. It is a fair approach that effectively strikes a balance among the conflicting equities surrounding the issue.

With so many voices competing for attention on acid rain, you must be tempted to throw up your hands in despair. In 1982 you did not despair; instead, you endorsed an acid rain control program that was both forward-looking and politically courageous. It met the key tests of substantial environmental benefit at least possible cost. And most importantly, it left to the states and to the free market the task of balancing conflicting regional and economic interests. A reaffirmation of that decision in 1984 would serve this nation well.

With all the arguments and counter-arguments on acid rain control, it is easy to forget that with some exceptions there is more that unites than divides us on the issue. While scientific uncertainty does remain, the broad outlines are clear:

-- substantial regional reductions in sulfur dioxide should begin as soon as possible;

-- damage has already been measured and more is being discovered;

-- the map of sensitive areas grows larger as our knowledge of the problem increases;

-- current efforts to quantify the extent of damage suggest that every year of delay costs billions of dollars in damage. Growing evidence shows that acid rain may threaten human health by virtue of its impact on water supplies;

-- public awareness and concern are increasing. The number of people who say they know something about acid rain has doubled in three years, now totalling more than 60 percent of Americans;

-- sulfur dioxide pollution has been identified as the main culprit in acid rain, along with nitrogen oxides in cold weather areas;

-- the principal options for reducing sulfur dioxide emissions are well-known, ranging from switching to lower sulfur fuel to coal-washing techniques and pollution control hardware. Promising new techniques are under development.

You will undoubtedly hear arguments against some of those points during your hearings, but I hope most of us can agree on the basics of acid rain control.

What, then, divides us? There is legitimate debate over the level of sulfur dioxide reduction necessary to accomplish the goal of environmental protection. The Committee must make a decision based on its judgment of the scientific and environmental evidence.

Another area of disagreement is more difficult. Every acid rain control program designed so far raises questions of fairness in one region or another and among the wide range of interest groups involved.. Those divisions are so complex and varied that no acid rain program can possibly accommodate all of them adequately and still remain politically feasible in the current climate.

Rather than forcing a stalemate on acid rain, this knowledge should actually free us to respond more quickly by allowing us to concentrate on the problem itself -- the existing and potential environmental damage caused by acid rain. In other words, we should concentrate on the needs of our environment, and recognize that no federal program, no matter how skillfully drafted or how cleverly constructed, can possibly satisfy everyone.

The federal government should mandate substantial regional reductions in sulfur dioxide pollution. It should leave to the states and the private economy the job of sorting out the equities of the reductions. State legislatures that wish to adopt market protection legislation for high sulfur coal may do so. Those states that wish to grant their electricity consumers the benefits of pollution control at lowest cost through low sulfur coal use may do so as well.

The free market is capable of sorting out the equities much more efficiently than any federal program, no matter how expertly designed or well-intentioned. A surplus of low-sulfur coal exists today and new supplies can be delivered quickly. Transportation costs, price and quality differences will dictate the choice of the best control options more effectively, and more cheaply, than any mandatory program. Best of all, new technologies that will assure long-term stability in high sulfur coal areas will be encouraged, and they will come on-line even faster with federal encouragement.

That is the approach you wisely chose in 1982. The alternatives proposed in well-meaning attempts to address perceived economic disruptions make the regional tensions worse, not better.

The major alternatives would require installation of scrubber technology and would provide a considerable subsidy for installation costs; or they would simply offer the subsidy and assume that the financial incentive would be powerful enough to prompt the installation of scrubbers. The alternative proposals would pay for the subsidy program by setting up a trust fund financed by a tax on the consumption of electricity, either in the 31-state acid rain mitigation region or in the lower 48 states.

That approach would add billions of dollars to the cost of acid rain control, putting new burdens on consumers, business and industry while producing no comparable environmental benefit. Worst of all, a major subsidy for the most polluting utilities would reward them for their earlier failure to comply with the Clean Air Act. And it would penalize responsible action in states like Montana, where scrubbers are already required, and in other states that have been leaders in cleaning up their air pollution.

Requiring scrubber technology would add $15 billion to $20 billion to control costs with no demonstrable environmental benefit. It would freeze in a technology that is expensive to install and operate and freeze out both low sulfur coal and new technologies now in the development stage.

A national consumption tax has no justification. It requires consumers in my state, who have already financed their own pollution control hardware, to pay for controls in other states that have ignored their past responsibilities under the Clean Air Act. Such a tax would reward the past failures of those states and punish the responsible actions by Montana and other states to clean up or prevent acid rain problems.

One alternative that has gained a great deal of attention is the "Waxman-Sikorski" legislation now pending in the House of Representatives. Under the financing scheme of H.B. 3400 ---all 17 western states would pay more in acid rain taxes than four of the six New England states. Thirteen western states would pay more than five New England states, and five western states would pay more than any New England state.

In fact, the top two, and three of the top five, contributors to H.B. 3400's trust fund would be in the West, where only a small, unsubsidized sulfur dioxide reduction would occur under the legislation.

When the percentage increase on the average utility bill is examined, the imbalance is even more striking. Montana's utility bill would increase more in percentage terms than many of the major contributors to acid rain, including Pennsylvania, Missouri, Illinois and West Virginia -- all among the top ten sulfur dioxide polluters.

In summary, that kind of legislation would be the worst of both worlds for Montana. Our low sulfur coal would be excluded from eastern markets, and our taxpayers would be asked to absorb major new electricity costs to benefit states that have not acted with our sense of environmental responsibility. To call that approach "unfair" is a staggering understatement.

In this context, it is important to remember that federal policy already excludes low-sulfur coal from major new markets through the "percentage reduction" requirement, which, in effect, requires scrubbers on new power plants. In the process it tilts the choice of cleanup options away from low-sulfur coal. Percentage reduction is discriminatory and unfair. It was based on political, not environmental, considerations, and it should be repealed. The mistake made in its adoption should not be compounded in the acid rain legislation.

Mandatory scrubbers and trust fund schemes are justified by their sponsors as necessary to prevent job shifts in the high sulfur coal fields in the East. Those mining areas are suffering hard times, and the Congress certainly should address their plight. But their problems exist today and should be addressed today. It offers false hope to promote acid rain control programs that will be phased in over the next decade as an adequate response.

Any major federal program will have an economic impact. For its size, acid rain control would have surprisingly little net impact, according to recent analyses, and in most areas the impact will be positive as new job opportunities arise to replace jobs lost. Dislocations concern us all, and they should be addressed with special benefits, early retirement, relocation and training programs.

But compassion must not lead to the creation of a multibillion-dollar distortion of an important environmental program like the Clean Air Act, when the cleanup can be accomplished quickly, cheaply and certainly through reliance on economic choice.

The Committee's assignment is challenging indeed -- to come up with an approach to acid rain control that yields the greatest real environmental benefit in the fastest, fairest, least disruptive way. I urge the Committee to reaffirm its environmental and social commitment by adopting an acid rain control program similar to the 1982 bill. It is a fair and realistic way to balance the regional equities in our free society.

Thank you.

Testimony on Regional Changes in the Growth and Behavior of Forests in Central Europe and Eastern North America

by

Dr. Ellis B. Cowling
Associate Dean for Research, School of Forest Resources
Assistant Director, North Carolina Agricultural Research Service
North Carolina State University
Raleigh, North Carolina 27650
Tel. 919/737-2883

Prepared for Public Hearings by the United States Senate
Committee on Environment and Public Works
Room 410, Dirksen Senate Office Building
Washington, D.C. 20510
9:00 a.m. - Tuesday, February 7, 1984

Statement by Dr. Ellis B. Cowling, Associate Dean for Research,
School of Forest Resources, and Assistant Professor,
North Carolina Agricultural Research Service,
North Carolina State University, Raleigh, North Carolina 27650

Prepared for Hearings on the causes and effects of acid deposition by
United States Senate Committee on Environment and Public Works.

Introduction:

For the past 24 years, I have been a professor of Plant Pathology and Forest Resources at Yale and North Carolina State Universities. During the past 14 years, a significant part of my educational, research, and administrative efforts has been aimed at the development of a more adequate understanding of changes in the chemical climate of North America and Europe and their effects on plants, animals, surface waters, and materials.

Since 1976, I have led a group of nearly 200 scientists in 50 institutions and agencies in the United States and Canada in establishing the National Atmospheric Deposition Program (NADP). The NADP is an interregional project (designated IR-7) of the State Agricultural Experiment Stations, various federal agencies, and private industries. Its major purposes are to: 1) encourage and coordinate research on the biological and other consequences of air pollution and atmospheric deposition; and 2) to establish a long-term monitoring network to measure chemical changes in the chemistry of rain and snow in various parts of the United States.

Since the fall of 1977, I have been active in the National Acid Precipitation Assessment Program. Since the fall of 1981, I have served as the United States co-chairman of the Triacademy Scientific Committee on Acid Deposition. In this and other roles with the National Academy of Sciences I have assisted in the development of the so-called

"Atmosphere-Biosphere Report" which was issued in 1981 and the so-called "Calvert Report" which was issued in 1983, I am very pleased to commend these reports for careful study by the Congress.

Since August 1979 I have served as Program Director for a Cooperative Agreement between the Environmental Protection Agency and North Carolina State University. The purpose of this Agreement is to provide EPA with an improved understanding of the effects of acid deposition on aquatic and terrestrial ecosystems. This Agreement provides a major linkage between the National Acid Precipitation Assessment Program and the community of university scientists who are actively engaged in research on the biological and water-quality effects of acid deposition in the United States.

Two of the most important outputs from this Agreement are a series of Critical Assessment Review Papers and an Integrative Critical Assessment Document summarizing the present status of knowledge about acid deposition and its environmental consequences. In his testimony before this committee last Tuesday, EPA Administrator William Ruckelshaus referred to these reports as"the most definitive integration and synthesis to date on the full range of issues critical to acid rain."

During the fall of 1983, I was invited to travel to West Germany for the purpose of assessing the recently developed decline of forests and to further encourage the development of a small working group of scientists in West Germany and the United States who:

a) will lead a multidisciplinary program of research to identify testable hypotheses about the causes and management of the dieback and decline of forests in the two countries; and

b) are willing to maintain effective liaison among government, industrial, and private forest organizations in the two countries with concerns about changes in the chemical climate and their effects on the productivity of forests.

I am proud to say that my colleague in testimony before this Committee, Dr. Arthur Johnson, will provide scientific leadership for this important scientific dialog with West Germany.

My testimony at these Hearings has been requested because of my knowledge and experience as a scientist. Thus, the ideas described here and in my verbal testimony before the Senate Committee are my own and may or may not be coincident with the policies and attitudes of the institutions and organizations with which I am affiliated.

Attachments:

Attached to and forming a part of this written testimony are several items which may prove helpful in understanding regional changes in the growth and behavior of forests and their relationship with air pollution and acid rain in central Europe and eastern North America.

Item 1) A report entitled "Observations in German Forests During the Late Summer of 1983." This report summarizes the results of a series of observations and consultations in West Germany that demonstrate, to my satisfaction, that scientifically unprecedented changes in the appearance and behavior of forests are taking place in large parts of Germany and other countries in central Europe.

Item 2) A list of available German-language publications illustrating the remarkable array of disease symptoms which are described in Items 1 and 3 and which provide the background for understanding and investigating possible causes of the widespread decline of forests in central Europe.

Item 3) The first three pages of a draft manuscript prepared in January 1984 by Dr. Peter Schütt, Professor of Forest Botany and Pathology at the University of Munich. This manuscript is intended to provide the first comprehensive English-language description and illustration of the symptoms of "Waldsterben--a general decline of forests in central Europe." Please note especially the statement on page 2 of Professor Schütt's draft paper which reads as follows:

> "There are a number of special facts and observations which make the *Waldsterben*-syndrome *a pathological phenomenon standing apart from ordinary tree diseases*. ... *They lead us to the impression that the syndrome is going to destroy the forest as an ecosystem*. On the other hand, we become more and more nervous because we are forced to learn more about the pathogenesis and primary causes before we get a realistic chance to stop a beginning catastrophy." (Underlining for emphasis by Ellis Cowling).

Item 4) A report of recent observations and experimentation relating to an unexplained decrease in growth, dieback, and decline of red spruce and a similarly unexplained inhibition of reproduction of all trees and shrubs on the summit and adjacent ridges of Mount Mitchell in western North Carolina. Mount Mitchell has special significance for the nation since it is the highest peak in all of eastern North America. This report was prepared by two colleagues in forest pathology at North Carolina State University--Professor Robert Bruck and his PhD student Sandy

Meier. These observations are in part similar to and in part dissimilar from those reported from Germany in Items 1-3.

Item 5) Reprint of a paper on "Discovering the Causes, Consequences, and Implications of Acid Rain and Atmospheric Deposition." This paper was published in September 1983 in TAPPI--the journal of the Technical Association of the Pulp and Paper Industry of the United States. The principal message of this paper is summed up in its by-line:

> "The forest products industry must think of itself as a net receiver rather than a primary emitter of air pollution."

Item 6) A list of four questionable assumptions underlying the Clean Air Act of 1970 and its amendments of 1977. This list was prepared originally for hearings on acid rain by the United States Senate Committee on Environment and Public Works in May 1982. This item was deleted from my testimony at that time on the assumption that these ideas might find more meaningful reception in later hearings dealing more specifically with possible revisions of the Clean Air Act.

General Comments and Conclusions:

The various papers and reports contained in the attachments to this testimony and the testimony of my colleague, Dr. Johnson, lead to the following general comments and conclusions:

1) Beginning in the late 1970's, economically valuable forests containing 10 different species of hardwood and softwood trees showed a very rapid and scientifically unprecedented series of symptoms in large parts of West Germany and nearby nations of central Europe.

These remarkable symptoms of stress include decreased growth; thinning of foliage; abnormal patterns of shoot, foliage, and root development; abnormal reproductive behavior; and decline and eventual death of trees, shrubs, and herbaceous vegetation. These symptoms are shown by trees growing at high and at low elevation; on nutrient-rich and nutrient-poor soils; on acid soils and basic soils; in natural stands and in planted stands; in mature forests of 80-140 years, middle age forests of 40 to 60 years, and young sapling stands of 5-20 years.

2) It is widely assumed (and I think correctly so) that air pollutants and/or acid deposition are among the stress factors that have caused or are contributing to the symptoms observed in the forests of central Europe. But this idea is still only an hypothesis; it has not been proven unequivocally.

3) Changes in the growth and behavior of softwood forests have also been observed recently in various parts of eastern North America. A consistent and simultaneous decrease in rate of growth since the early 1960's has been reported in red spruce, shortleaf pine, and pitch pine. Both young and mature stands of red spruce have also shown a progressive dieing back from the top, particularly at high elevation. The area of affected spruce forests extends from southeastern Canada to the southern Appalachian Mountains. At the summit of Mount Mitchell, reproduction of both red spruce and Frazier Fir and all woody shrubs was found to be inhibiited above about 6,350 feet in elevation.

4) It is widely assumed (and I think correctly so) that air pollutants and/or acid deposition are among the stress factors that have caused

or are contributing to these symptoms in eastern North America. But this idea, like those pertaining to central Europe, is still only an hypothesis; it has not been proven unequivocally. It should also be recognized that the concentrations of sulfur oxides in many parts of Germany are substantially greater than those in areas where forest effects have been detected in eastern North America.

5) In recent years, the term "acid rain" has captured the imagination of the people of the United States, Canada, and Europe. This has come about in part because of the now well established contribution of sulfur and nitrogen oxides to the acidification of surface waters, the mobilization of toxic metals, and related effects on fish and other forms of aquatic life in certain sensitive regions of northern Europe and eastern North America.

6) These detrimental effects of aquatic ecosystems due to wet and dry deposition of acidic and acidifying materials from the atmopshere are caused in large part by emissions from combustion of fossile fuels and smelting of metal ores. Utility and other industrial boilers, metal smelters, transportation vehicles, and residential and commercial space and water heating are the most important sources of sulfur and nitrogen oxides which lead to wet and dry deposition of acid substances. But they are also major sources of other air pollutants including: fluoride, the precursors of ozone and other photochemical oxidants, toxic metals, unburned hydrocarbons, and many other volatile organic compounds.

7) The net beneficial and detrimental consequences of these emissions include the following:

   a) fertilization of crop and forest land with nutrients that are essential for plant growth and development;

b) increased haziness and decreased visibility in urban, surburban, rural, and even remote areas;

c) increased corrosion of metals and accelerated weathering of stone and masonry materials in buildings, sculpture, engineering structures, and historical monuments;

d) increased respiratory and other diseases of human beings;

e) increased contamination of drinking water supplies by gases, aerosols, and particulate chemicals (including acids, toxic metals, and volatile organic materials) by deposition from the atmosphere or leaching from the soils and bedrock of watersheds;

f) increased damage to crops and forests by toxic gases such as ozone and sulfur dioxide and perhaps also by atmospheric deposition of acidic and acidifying substances;

g) loss of fish populations and other forms of aquatic life in sensitive surface waters.

8) It is now widely accepted that any substantial change in national or regional emissions of sulfur and/or nitrogen oxides will lead to an approximately corresponding change in amounts of deposition and an attendant change in the several societal costs and benefits listed under item 7.

9) Energy conservation, and decreased use of energy and materials, are essentially the only means by which significant decreases in emissions and deposition of acids, toxic metals, photochemical oxidants, and other injurious air pollutants can be achieved in the absence of major changes in the emissions standards of the United States and Canada. The recent voluntary decision of the Tennessee Valley Authority to achieve a 1,000,000 ton per year

decrease in sulfur oxide emissions stands as a notable exception to this general conclusion.

10) Even if a decision were reached in 1984 or 1985 to mandate significant decreases in sulfur oxides or other emissions, it probably will take at least 5 years to develop specific state, regional, national or international implementation plans to achieve the required decreases. Also, at least another 5 years probably will be required to design and build the machinery and control systems necessary to achieve the targeted decreases in emissions. During this at least 10-year period of debate, planning, engineering design, and evaluation, new biological, atmospheric chemical, meteorological, and climatological insights will be developed which will help refine whatever management strategies may be recommended. Therefore, it seems prudent that the United States begin the planning and evaluation procedures now, recognizing that research is continuing and that the earliest possible date for achievement of significant decreases in emissions (except through energy conservation and decreased use of energy and materials) will be the mid-1990's.

Summary

Our present energy and environmental policies are resulting in continuing change in the chemical climate or North America and Europe. Important changes are taking place in the lakes, streams, fields, and forests on which both the abundance and the quality of human life depends. Wise management of these resources requires knowledge and communication among biologists, hydrologists, atmospheric chemists, meteorologists, climatologists, regulatory strategists, and both industrial and political leaders in the United States and Canada.

Let us continue that communication by focusing our collective knowledge and good judgement in the development of more adequate plans for management of air quality and its effects on human health, crops, forests, animals, soil surface waters, and materials. The current debate about possible revision of the Clean Air Act is one of the most important occasions for such collective thinking.

Item 1

North Carolina State University

Office of the Dean

School of Forest Resources
Box 5488, Raleigh 27650

October 7, 1983

Memo to: Colleagues in Forestry Research within:
- the National Atmospheric Deposition Program (IR-7)
- the National Acid Precipitation Assessment Program (USA)
- the Southern Forest Research Center
- the Tri Academy Scientific Committee on Acid Deposition
- the NCSU Acid Deposition Program
- the Acid Rain Foundation
- the Southern Appalachian Regional Resources Management Cooperative
- other scientists in Europe and North America

From: Ellis B. Cowling Ellis B. Cowling

Re: Observations in German Forests during the late Summer of 1983

The week of September 15-21, 1983 stretched my mind and imagination further than they have been stretched in many years. That week provided my first opportunity for direct observation of the decline of forests which has developed in West Germany in the years since 1979.

The observations and consultations during that week demonstrate, to my satisfaction at least, that scientifically unprecidented changes in the appearance and behavior of forests are taking place in Germany.

As indicated in greater detail in the attached report, the most remarkable of these disease symptoms include the following:

- simultaneous and rapid decline of forests involving 4 coniferous and 6 angiospermous species of trees growing under many different soil and site conditions;
- active casting of green leaves and shoots;
- abnormal shape, size, geometrical form, and distribution of leaves and shoots;
- decreased growth and abnormal allocation of photosynthate among the foliage, annual increment along the tree stem, adventicious shoots, distress crops of seeds and cones, and fine roots and mycorrhizae;
- death of herbaceous vegetation under the canopy of some affected trees; and
- development of microscopic crystals of calcium sulfate in the stomata of some affected spruce.

North Carolina State University is North Carolina's original land-grant institution and is a constituent institution of The University of North Carolina

It is widely assumed (and I think correctly so) that air pollutants and/or acid deposition are among the stress factors that have contributed to the symptoms described above. But this idea is still only an hypothesis; it has not been proven unequivocally.

It is also clear that the symptoms of progressive decline of forests of various tree species in Germany are not the same as the symptoms of dieback observed in high-elevation spruce forests in the eastern United States and southeastern Canada. Nevertheless, some decline in growth rate of forests in eastern North America is also suggested by recent dendrochronological analyses.

Most of the remarkable symptoms listed above have been reported in the German-language literature of forestry, soil science, or environmental protection in central Europe. But these reports have appeared only recently, or for other reasons are not well known (or known at all) in North America. Because of this, arrangements are proposed to do two things:

1) Publish in North America, a comprehensive and well illustrated English-language description of the stress symptoms shown by the forests in Germany. I believe this publication should include or be followed by an appeal for scientific interest in the phenomena of forest decline by forest pathologists, tree physiologists, forest ecologists, and soil scientists in North America and elsewhere.

2) Establish a small working group of scientists from Germany and the United States which will:

- identify testable hypotheses about the possible causes of forest decline and/or forest dieback in the two countries;
- initiate a cooperative program of research to test these hypotheses; and
- maintain an effective liaison with governmental, industrial, academic, and private organizations concerned with changes in the chemical climate and their effects on the productivity of forests in Europe and North America.

I am personally indebted to Mr. Shepard Stone of the Aspen Institute Berlin; to Hermann Hatzfeld, Dieter Deumling, Alexander Von Elverfeldt, Detler Kraft, Bernard Ulrich, and Karl Rehfuess; and especially to Peter Schutt for their cordial hospitality and generous contributions to my continuing education in recent weeks.

Looking forward to discussing these observations and ideas with you during the meetings of various organizations in the weeks ahead.

EBC/sp

Report on Travel and Observations of Forest Decline in West Germany - September 15-21, 1983

by Ellis B. Cowling
Associate Dean for Research, School of Forest Resources
Program Director, Acid Deposition Program
Director, Southern Forest Research Center
Assistant Director, North Carolina Agricultural Research Service
North Carolina State University
Raleigh, North Carolina 27650 USA
Tel: (919)-737-2883

Purpose of Travel:

1) To participate in an international conference on the management of transboundary air pollution and its effects on forests. The conference was called by the Aspen Institute Berlin to facilitate an informal exchange of views among 5 scientists and 22 leaders of selected national, industrial, and international organizations from western and eastern Europe, Canada, and the United States.

2) To participate in field excursions to four areas in northwestern and southeastern Germany where extensive decline has been observed in spruce, fir, pine, and beech forests.

3) To develop plans with Dr. Peter Schutt, Professor of Forest Botany at the University of Munich for a comprehensive publication in the English language of the remarkable pattern of visible symptoms and decreased growth of forests in Germany.

4) To further encourage the establishment of a small working group of scientists in West Germany and the United States who

  a) will lead a multidisciplinary program of research to identify testable hypotheses about the causes and management of the dieback and decline of forests in the two countries;
  b) are willing to maintain effective liaison among government, industrial and private forest organizations in the two countries with concerns about changes in the chemical climate and their effects on the productivity of forests.

1) Report of the Conference at the Aspen Institute:

The Aspen Institute Berlin is a private organization specializing in international economic and environmental problems. Invitations to the conference (see attached list of participants) were extended by Mr. Shepard Stone, Director of the Institute and the conference co-chairman, Mr. Hermann Hatzfeldt, a private forest-estate owner in Germany, and Mr. Gregory Wetstone, program leader at the Environmental Law Institute in Washington, DC. I was one of five scientists invited to the meeting. The other participants were leaders in government, industry, and international organizations from various European countries, Canada, and the United States. The format was an "informal, off-the-record" discussion of two major topics:

1) Obstacles to industrial and government decisions about international air pollution and its effects on forests; and

2) Methods to encourage greater scientific, government, and industrial cooperation in decreasing environmental threats to forests.

The conclusions and recommendations of the conference are attached. They include suggestions for increased communication among scientists and environment-management leaders in industry, government, and international organizations.

2) Field excursions and observations:

The four field excursions included visits at the following locations:

1) A private forest estate in the northernmost part of Rhineland-Palatinate near the town of Siegen.

2) Both privately owned and state-owned planted spruce and beech forests in the eastern part of North Rhine Westphalia near the town of Paterborn.

3) A naturally regenerated state-owned forest of mature spruce and fir near the border with Czechoslovakia in southeastern Bavaria near the town of Zwiesel.

4) A privately owned forest estate with both planted and naturally regenerated mature and sapling stands of spruce, fir, pine, beech, larch, and alder in eastern Bavaria near the town of Regensberg.

General Observations:

During all four field excursions I was impressed with the extent to which foresters in private, industrial, and government employment in West Germany are worried about "Waldsterben" - a rapidly developing pattern of changes in the appearance and behavior of forests in many parts of Germany. The symptoms of decline are not identical in rate or sequence of development in various species of trees or parts of the country. Nevertheless, they include the following features, some of which have never or only very rarely been reported before in the literature of forestry and/or plant pathology. I have underlined for emphasis, certain features which I consider to be of special scientific interest.

A) The changes have developed very rapidly and unevenly, but roughly simultaneously (since 1979) in many different species and types of forests (principally fir, spruce, beech, and pine but also including maple, oak, larch, birch, alder and ash).

B) The symptoms include:

1) A general thinning, change of color, and altered morphology of the leaves and total tree canopy, especially in spruce, fir, beech, and pine. Loss of foliage and formation of "hanging (nearly vertical) branches is common in both spruce and fir. Loss of foliage and sparse development of foliage is common in beech.

2) Formation of smaller-than-normal leaves (especially in beech and spruce) and misshapen (lobed) leaves (especially in beech).

3) Active casting (abscission) of green leaves (especially in beech, fir, spruce, larch, alder and oak) and of green shoots with intact green leaves (especially in spruce and pine and occasionally in oak.

Although certain insects and squirrels are known to cut leaves and shoots, visual and microscopic observations confirm that this process in beech results from a clearly decernable abscission layer at the base of the fallen leaves. It should be noted that the active casting of green leaves is an extremely rare or nearly unknown symptom in diseases of plants caused by fungi, bacteria, viruses, nematodes, and all the air pollutants which have been studied to date. Leaves of diseased plants usually are retained on the plants, or, if they are dropped, the leaves almost invariably turn brown or at least yellow and show clear signs of pathogenesis or senesence before they are dropped.

4) Decreased diameter growth (especially in fir during the past 20 years, in spruce during the past 10 years, and beech during the past 5 years).

5) In spruce and fir, the width of annual rings in affected trees has been found to be greater high up on the stem and much less (or no ring is formed at all) low down on the stem. This kind of abnormal distribution of annual increment has rarely been reported before.

6) Very heavy cone and/or seed crops have been observed three-years-in-a-row in spruce, pine, and beech. This has not been reported in fir.

"Distress crops" of cones and seeds are found in many tree species. They commonly occur in years following drought and attack by various biotic stress factors such as root, stem, and foliage diseases and insects. Such crops usually occur in only a single year. In theory, this is because the inducing stress does not recur and/or because the nutrients needed to form the extra cones and/or seeds are depleted by the first distress crop. Thus, distress crops three years-in-a-row is also an essentially unique feature of the present condition of German forests.

7) Unusually large numbers of adventicious shoots are formed on affected spruce and epicormic branches on affected beech trees.

These symptoms have also been observed in other species but I failed to note which ones. Such shoots are commonly formed in young trees following drought but the number of such shoots and branches are larger now than has been noted previously.

8) Lack of or very small numbers of fine feeder roots and mycorrhizal roots (a symbiotic association of fine roots and beneficial fungi). This poor development of fine roots is especially common in affected beech but is less common and apparently less intensive in spruce and fir.

9) Discoloration and/or decreased moisture content of stem and root wood. This symptom varies with different species but I failed again to

make adequate notes on which species commonly show this change.

10) Very brittle wood, especially in branches. This symptom has been observed in affected beech, but not in spruce or fir trees.

11) Marked deficiency of magnesium has been observed in foliage of affected spruce trees.

12) Death of most or all herbacious vegetation immediately beneath the canopy of some affected trees. We observed this condition in spruce and beech forests at two locations in Bavaria. We did not see it in North Rhine Westphalia. Professor Ulrich says he has seen this condition near Gottingen in central Germany and in Czechoslovokia.

Under spruce, the contrast between a lush green carpet of mosses, grasses, and woody shrubs outside the drip line of the tree canopy and the complete absence of herbaceous vegetation (or only dead vegetation) inside the drip line (directly under the canopy) was extremely striking. The border between these two zones was extremely sharp with essentially no transition zone from lush green to dead vegetation. Lycopodium spp., many mosses, and grasses were among the plants showing this sharp contrast.

13) Formation of crystals of calcium sulfate in the stomata and on the surface of needles of affected spruce. Electron micrographs of this remarkable symptom are striking indeed. To my knowledge this symptom has not been reported before.

C) This wide array of symptoms has developed:

1) Very rapidly (during the years since 1979 or 1980)

2) On many different species of forest trees (principally on fir, spruce, beech, and pine but also on maple, birch, larch, maple, alder, ash, and oak).

3) In planted forests and naturally regenerated forests of most of the above species.

4) On trees growing on both fertile and infertile soils and both basic and acidic soils (ranging in pH from as low as 3.5 (or slightly lower) to 8.0).

5) In stands on east-facing, west-facing, north-facing and south-facing slopes in southern Germany (especially Bavaria) but more commonly on north-west facing slopes in northwestern Germany (North Rhine Westphalia) and on west-facing slopes at elevations above 800 meters in the Black Forest area of Baden Wartemburg.

6) In some forest districts, the canopy and other visible symptoms listed under section B (above), have been reported in stands of all ages including mature, sawtimber size trees (80-150 years), middle age, pole-size trees (35-80 years), and young sapling stands (1-35 years).

In other areas, a greater incidence of these symptoms has been reported in older stands.

7) Although these symptoms often have been reported in high elevation forests (800-1400 meters), essentially similar symptoms also have been observed in forests at moderate (400-800 meters) and at low elevation (coastal areas to 400 meters above sea level).

D) Although the first survey of the geographical extent of these forest-decline symptoms indicated that about 8% of the total forest area of West Germany was affected in 1981, preliminary results of a more recent (1983) survey indicate that as much as 25% of the forest area may be affected.

E) Most German forests are managed by selective cutting of individual trees or groups of trees. Salvage cuttings are made of all dead or weakened trees. These two widespread forest practices essentially eliminate dead and weakened trees. Thus, most severely affected trees are not visible in the forest landscape.

Trees showing the symptoms of forest decline make up an important part of the current harvest of timber in Germany. Crude estimates range from as low as "about 10%" in some forest districts to "nearly all of the annual cut" in other areas. These crude estimates are of course complicated by the occurrence of various local events including epidemics of bark beetles and fungal diseases of various types, and by snow and wind-storms which topple or break stems of individual trees, groups of trees, or whole stands.

F) There has been no important depression of timber prices caused by an increased supply of timber and no cutting of prices for "decline" vs. "healthy" trees by the forest products industry. The occurrence of very brittle branches on "decline" trees, however, has led to some worry that the strength of stemwood formed since the onset of decline might be less than that of wood formed prior to the onset of decline symptoms.

G) Although various "secondary" and "stress following" fungi and some insects have been found on trees showing decline symptoms, no evidence of a consistent or even very frequent association of the decline with biotic pathogens or insects has been found.

H) Four major hypotheses or "schools of thought" have been developed by various forest scientists in attempts to explain the current decline of forests. Only one of these ideas (Prof. Bernard Ulrich's acidification-aluminum toxicity hypothesis) is presently well known in North America. As in all countries around the world, the hypotheses proposed by German scientists to explain complex natural phenomena are reflections in part of the scientific background and experience of the scientists involved.

Although my own understanding of these various hypotheses and schools of thought is incomplete and no doubt faulty, I have attempted to describe briefly below four of the most common ideas. The order I have chosen is alphabetical according to the name of the major proponent of each hypothesis and not according to the priority or weight of observational, experimental, or theoretical evidence on which each hypothesis is founded.

1) The gaseous-pollutant hypothesis of Prof. H. Prinz of the air pollution research institute at Essen. This hypothesis is based mainly on field observations of ozone and sulfur dioxide concentrations in various parts of Germany and controlled exposures of various tree species to these pollutants both alone and in various combinations.

2) The magnesium-deficiency hypothesis of Professor Rehfuess and his colleagues in the Department of Soil Science at the University of Munich. It is based primarily on field observations and both soil and foliar chemical analyses in stands of spruce at high elevation. According to this hypothesis the decline symptoms are a product of extreme magnesium deficiency in trees with plentiful supplies of nitrogen and calcium. A recent paper on this hypothesis in Forstwissenschaftliches Centralblatt [102(3):167-181] indicates that:

> "There is evidence that acid deposition from the atmosphere may contribute to these growth disturbances; it adds nitrogen to the ecosytem but may leach out magnesium and calcium from needles and soils. The leaching from the foliage is presumably accelerated by episodic ozone or frost damage to cuticles and cell membranes. The magnesium deficiency seems to lead to decreased frost hardiness of the spruce needles. There is no indication that toxic effects of heavy metals may be causing the disease."

3) The general stress hypothesis of Prof. Schutt and his colleagues in Department of Forest Botany at the University of Munich. This hypothesis is based on field and laboratory observations of symptoms in various tree species (especially spruce and beech). These observations include changes in gas-exchange rates and formation of plant growth hormones and secondary metabolites during symptom development. According to this hypothesis, air pollution has led in recent years to a decrease in net photosynthesis and associated diversion of photosynthesis from mobil carbohydrates to relatively less mobile and toxic secondary metabolities. This in turn leads to a poorer energy status in roots and accumulation of toxic substances in shoots which leads to poor development of fine root and mycorrhizae and to foliar decline symptoms. Reduced energy status increases the susceptability of the trees to other stress factors such as drought, nutrient deficiency, and the usual secondary biotic pathogens.

4) The acidification-aluminum toxicity hypothesis of Prof. Ulrich and his colleagues in the Department of Soil Science at the University of Gottingen. This hypothesis is based mainly on observations below ground. In short, this hypothesis holds that the natural acidification of forest soils is accelerated as a direct and/or indirect result of deposition of acidic and acidifying substances from the atmosphere. Increased acidity (or loss of alkalinity) in the soil leads to increased concentrations of soluble aluminim ions in the soil solution which in turn results in accelerated morbidity and/or decreased synthesis of fine feeder roots. Lack of (or poor functioning of) feeder roots leads to increased moisture and nutrient stress and eventually to "drying out" and death of the trees, particularly during periods of drought.

During the concluding session of the conference at the Aspen Institute, Professor Ulrich offered the following statement which I consider very significant in the light of the above-listed hypotheses:

"It is a matter of fact that there is no scientific consensus about the causes of the forest damage, even if there is general agreement about the importance of air pollutants. It seems that this lack of consensus is not due to missing data, but to a lacking acceptance of different scientific schools of thought. This leads to scientific statements which seem to contradict each other and this leads to confusion. It is, therefore, the responsibility of the national and international science administrations to force the different scientific schools of thought into a process of communication and exchange."

3) Development of Plans for a comprehensive, English-language description of the symptoms of forest decline in Germany.

In recent months it has become apparent that the decline of forests in Germany is a much more complex and scientifically unique phenomenon than is generally appreciated in North America. This is due in part to the following:

A) Although the observations and acidification-aluminum toxicity hypothesis of Prof. Ulrich are rather widely known, the observations of other scientists are less well known.

B) The forest decline is developing very rapidly so that the symptom picture is changing progressively with time.

C) Most published descriptions are in the German language and are published in journals which are not widely read in North America.

D) Most of the reports available in Germany prior to the summer of 1983 emphasized air-pollution, acid-deposition, or soil-chemical measurements rather than visible symptoms shown by the trees themselves.

The first strongly symptom-oriented description of the forest decline in Germany I have heard was presented by Professor Peter Schutt during his lecture at the International Conference on Acid Deposition: Effects on Forests held in Quebec in June 1983. This lecture was very well illustrated. It emphasized the unique features of the symptom pattern and the "nervousness" many forest scientists felt because the symptoms were so unique that probable causes could not be assigned.

At that time I urged Prof. Schutt to publish a complete technical description of the symptoms in the English language together with an appeal for interest by the international community of scientists with expertise in forest and plant pathology, plant physiology, forest ecology, and soil science.

In August, Dr. Schutt and his colleagues published an illustrated booklet entitled: "So stirbt der wald: Schadbilder und Krankheitsverlauf" (So dies the forest: symptom picture and disease development). This 95-page summary shows symptoms in fir, spruce, pine, beech, and other hardwoods. It is available for purchase from BLV Verlagsgeschuschaft in Munich. Other illustrated symptom descriptions have been published by Prof. Rehfuess in

Allgemeine Forst Zeitschrift 241(6):601-610 in June of 1983, by a series of authors in the July 1983 issue of Allgemeine Forst Zeitschrift 102(7):638-699, and by the Ministers fur Ernahrung Landwirtschaft und Forsten Nordrhein-Westfalen in der Reihe in their "Informationen fur den Waldbesitzer" Nr. 12. All of these publications provide only German-language text descriptions.

During my visit with Prof. Schutt in September he agreed to prepare an initial draft text of a technical symptom description. I agreed to help prepare the English-language text and to arrange for its publication in Environmental Science and Technology or another suitable refereed journal in the United States I also agreed to submit a "Letter to the Editor" or other separate Note calling attention to the unique scientific features of the decline phenomenon described in this publication. These "letters" or "Notes" would be submitted to selected plant pathology, plant physiology, ecology, and soil science journals. Dr. Schutt and I agreed to complete these publications by November, 1983. After my return to the U. S. the editors of Environmental Science and Technology agreed to receive a manuscript in November with hoped-for publication in February 1984.

4) Cooperative Research on Forest Decline between German and United States Scientists.

As a part of the Cooperative Agreement between the Acid Deposition Program at North Carolina State University and the U. S. Environmental Protection Agency, funds have been provided to support an exchange of visits and formulation of plans for a cooperative program of research between West German and United States scientists. Matching funds have been offered by German sources. Primary scientific contact persons are Prof. Bernard Ulrich in Germany and Prof. Arthur Johnson in the United States.

In the light of the comments and observations described in sections 2 and 3 of this trip report, I have offered the following suggestions to Drs. Ulrich and Johnson:

a) The composition of both the American and German scientific groups should be examined so that the collective competence of the joint group includes plant pathologists, plant physiologists, air pollution specialists, and soil scientists;

b) That the primary purpose of the exchange of visits and cooperative research plans should be to define alternative testable hypotheses concerning the potential causes of forest dieback and/or decline in the two countries; and

c) That the visible and physiologically or ecologically measurable symptoms of stress shown by the trees themselves should be accepted as a primary guide to the hypotheses to be tested in cooperative research in the two countries.

Relationship Between Forest Decline in Germany and Dieback of Spruce Forests in Eastern North America

This report of observations and communication with various scientists during field excursions in Germany, would not be complete without some mention of the distinct contrast between the general "decline" of forests in Germany and the "dieback" of spruce observed in the northeastern United States and southeastern Canada.

In North America the trees clearly die back from the top. This condition is found almost exclusively in forests at high elevation where contact with cloud moisture is common place. This condition has been reported only in spruce stands. The affected stands are not of great economic value.

In Germany, by contrast, the trees are clearly declining (showing sparse foliage and slow growth) rather than dieing back from the top. This condition is not confined to high elevation and/or cloud-covered forests and occurs in many different species of trees. Many of these forests are of very great economic value.

Aspen Institute for Humanistic Studies

D-1000 Berlin 38
West Germany
Telefon 803 90 41
Cable: Aspen Berlin

September 16, 1983

.O. Anderson
hairman of the Board
E. Slater
resident

hepard Stone
irector
aniel Hamilton
eputy Director

LIST OF PARTICIPANTS

Conference on

Saving the Forests

International Pollution and Environmental Responsibility

sponsored by the Aspen Institute Berlin

September 15 - 17, 1983

Ellis B. Cowling
School of Forest Resources
North Carolina State University
Box 5488
Raleigh, N.C. 27650

A. J. Fairclough
Director
Environment Directorate
Commission of the European Economic Community
Rue de la Loi 200
1049 Brussels

Fitzhugh Green
Associate Administrator
U.S. Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

Daniel Hamilton
Deputy Director
Aspen Institute Berlin

Hermann Graf Hatzfeldt
Schloss Schönstein
5248 Wissen/Sieg

David Hawkins
Natural Resources Defence Council, Inc.
1725 I Street, N.W.
Suite 600
Washington, D.C. 20006

Stefan Jarzebski
Institute for Environmental Engineering
Polish Academy of Science
716480 Zabrze

Heinrich Frh. von Lersner
President
Federal Environment Agency
Bismarckplatz 1
1000 Berlin 33

Erik Lykke
Director General
General Coordination Department
Ministry of Environment
P.O.B. 8013
Oslo 1

James MacNeill
Director
Environment Directorate
OECD
2, rue André Pascal
75775 Paris Cedex 16

../2

Hans Martin
Senior Advisor
Federal LRTAP
Liaison Office
Atmospheric Environment
Service
4905 Dufferin Street
Downsview, Ontario M3H 5T4

Jan Materna
Forestry and Game Management
Research Institute
Zbraslav N.VLT
CSSR-Strnady 167

Konrad von Moltke
Institute for European
Environmental Policy
Aloys-Schulte-Strasse 6
5300 Bonn 1

Curtis Moore
Counsel
Committee on Environment
and Public Works
U.S. Senate
Washington, D.C. 20510

Michael Perley
Executive Director
Canadian Coalition on
Acid Rain
112 St. Clair Avenue West
Suite 504
Toronto, Ontario M4V 2Y3

Goran Persson
Director
Research Department
National Swedish Environment
Protection Board
Box 1302
171 25 Solna

John Quarles
Chairman NEDA-CAAP
Morgan, Lewis & Bockius
1800 M Street, N.W.
Washington, D.C. 20036

George Rejhon
Department of External
Affairs
Ottawa Canada

Jochen Seeliger
Member of the Management
Association of the German
Coalmining Industries
Friedrichstraße 1
4300 Essen 1

Toshio Senshu
Manager of Environmental
Laboratory
Central Research Institute of
Electric Power Industry
2-11-1 Iwado-Kita
Komae Shi
Tokyo 201

Shepard Stone
Director
Aspen Institute Berlin

Karola Taschner
European Environmental Bureau
Rue Vautier 29
1040 Brussels

Bernhard Ulrich
Institute of Soil Science
and Forest Nutrition
University of Göttingen
Büsgenweg 2
3400 Göttingen

../3

Hubert Vogelmann
Chairman
Department of Botany
University of Vermont
Marsh Life Science Building
Burlington, VT 05405

Helmut Weidner
International Institute
for Environment and
Society
Science Center Berlin
Potsdamer Straße 58
1000 Berlin 30

Gregory Wetstone
The Environmental Law Institute
1346 Connecticut Ave.,N.W.
Washington, D.C. 20036

Soshiro Yoshikawa
Deputy Director
Environmental Protection
Guidance Devision
Industrial Location and
Environmental Protection
Bureau
Ministry of International
Trade and Industry
1-3 Kasumigaseki
Chiyoda-Ku
Tokyo

OBSERVERS:

Heinz-Detlef Gregor
Director
Federal Environment Agency
Bismarckplatz 1
1000 Berlin 33

Hanna Beate Schöpp-Schilling
Assistant Director
Aspen Institute Berlin

Jochem Frh. von Uslar-Gleichen
Counsel
The Berlin Senate's Administration
for Cultural Affairs
Europa-Center
1000 Berlin 30

Final Communication from a Conference at The Aspen Institute Berlin on Saving the Forests: Internation Pollution and Environmental Responsibility

September 15-17, 1983

Participants exchanged views on current scientific evidence of the destruction of forest resources now occurring, and were greatly concerned by the unprecedented scope of this ecological calamity.

Participants also recognized that airborne pollutants, particularly sulphur and nitrogen compounds, play a major role in this destruction, and that such pollutants are also causing other damages to the ecosphere including freshwater acidification and depletion of fish populations, deterioration of materials, and risks to health of yet undecided magnitude.

Participants therefore urge the parties to the 1979 Geneva Convention to reduce emissions of sulphur and nitrogen oxides beginning imediately, to the extent required to protect sensitive resources.

Recent work by the OECD (such as the report of the Coal Industry Advisory Board) and other national and international bodies demonstrates that the policies and technologies needed to reduce emissions of SO_x and NO_x are available. While the costs of such emission controls are significant, OECD and other studies indicate that the economic benefits of controls equal or exceed costs.

The experience of a number of countries, notably Japan, indicates that available technologies are effective.

The costs of emissions are now being borne largely in the form of avoidable damages to forest and water resources (and economic activity based on those resources), to property through accelerated corrosion, and to human health in some areas.

Such costs should be borne by the industries responsible for the emissions consistent with the "polluter pays" principle. Financing control programs may in some cases require transitional assistance from public sources.

International coordination of emission reduction strategies will also be required to avoid competitive disadvantages to certain industries.

Per capita investments in energy use are generally of the order of 1000 to 3000 US Dollars per year in the various industrial nations of Europe, North America, and Japan. In contrast, investments in research and development relating to the environmental consequences of abundant energy use usually are on the order of a few cents to a few dollars per person per year.

Investments in research and development relating to the environmental consequences of energy use should be increased markedly so that society can be assured that minimum damage to health and welfare is acnieved.

Increased monitoring is needed to provide a clearer picture of what is occurring. Increased research is also needed to expand our understanding of the mechanisms by which air pollutants affect forest ecosystems. These needs, however, must not be made excuses for failing to act now to reduce emissions.

Participants also considered past and current efforts of existing international institutions in dealing with transboundary pollution problems. It was agreed that further meetings of international experts should be convened, under the auspices of the Aspen Institute, to identify at an early stage other international pollution problems which may require concerted international responses.

Item 2

Waldsterben - A General Decline of Forests in Central Europe: Symptoms, Development, and Possible Causes of a Beginning Breakdown of Forest Ecosystems

Prepared by Dr. Peter Schütt
Professor of Forest Botany and Pathology
University of Munich
West Germany

1. Introduction

Sometime in 1979 or 1980 foresters in the Bavarian Forest and in other parts of Southern Germany realized for the first time a certain change in the appearance of old Norway spruce trees which they never had seen before. It occurred both in the mountains and in flat regions around Munich and led to partial or total defoliation and finally to death.

At that time one of the main problems of German forest pathology was white fir decline ("Tannensterben") a more or less mysterious disease which had occurred periodically on the North side of the Alps during the past 250 years. Around 1970 Tannensterben became evident once again; this time it was very wide spread and rather intense. So, a research program was established in order to find out the causes of this complex-disease.

Very soon, however, a new disease of spruce took the leading position in the attention of pathologists and practical foresters. From 1980 to 1984 it became evident over Central Europe, southern Scandinavia, northern Italy, parts of the Balkan countries and (probably) large areas in eastern Europe. Especially in Norway spruce, the progress of the disease was very hard to predict. In certain remote regions it sometimes breaks out within a few months.

Scots pine (Pinus sylvestris) followed spruce with similar symptoms; and since 1981 we have observed an even more obscure disease-syndrome in European Beech (Fagus sylvatica). Again with a few new symptoms, again with a very high speed of distribution, and again with a sometimes extremely short period of time between first observation of symptoms and death of affected trees. "Waldsterben" in beech now occurs over large parts of Central Europe; it can be observed in the Alps, in the Appennin-Mountains, and in Southern Scandinavia.

Now, at the beginning of 1984, the situation has become still worse. Waldsterben-symptoms are to be found in almost every tree species. Several shrubs and herbs also have been affected. In the meantime, Waldsterben has not only become a major problem in forestry but also in public discussions. In West Germany it is now an important political question. As a consequence, numerous research activities have started in different fields. In this article, however, stress is laid on the botanical and pathological aspects of the syndrome.

2. Chronology of Damage and Description of Symptoms

2.1 General aspects

There are a number of special facts and observations which make the Waldsterben-syndrome a pathological phenomenon standing apart from ordinary tree diseases. Moreover, these facts are to a certain degree difficult to interpret. They lead us to the impression that the syndrome is going to destroy the forest as an ecosystem. On the other hand, we become more and more nervous because we are forced to learn more about the pathogenesis and the primary causes before we get a realistic chance to stop a beginning catastrophy.

The following items are characteristic for the present situation:

- "Waldsterben" started almost at the same time in different parts of Europe.
- Within four years it was found over large parts of the continent. In 1984 it is still increasing in intensity and geographic distribution.
- Within four years it attacked almost every tree species, native and foreign. It also affects various species of shrubs and herbs.
- The symptoms are heterogeneous, even within the same species.
- Waldsterben occurs with a similarity intensity on poor and rich and on wet and dry soils, independent of their geological origin.
- It also occurs independently of climatic differences and rather independent of the direction of the slop in hilly or mountainous terrain.
- Differences in forest management practices or in the structure of the forest (single species vs mixed stands, planted in natural stands) do not have an influence on the amount of damage.
- Young trees are generally less affected than older ones but exceptions also occur.
- Some of the typical symptoms have never been described before (especially in beech and spruce, larch, and some deciduous trees of lesser importance).

With respect to the primary causes the distribution pattern of attacked trees or stands, as well as the pathogenesis and the symptoms, do not give more than some rough hints in the right direction.

At the moment Waldsterben seems to belong to a group of forest diseases which we call disease complexes for want of a better name. They are characterized by collaboration of several single pathogenic events--biotic or abiotic--which attack simultaneously or one after another so that it is difficult to decide which of the causes is primary and which is secondary. In almost every case a broad spectrum of secondary parasites is involved Since these secondary events often differ in time and space, the symptoms, too, can vary from location to location.

A country-wide survey of Waldsterben-symptoms was undertaken in the fall of 1983 by the regional governments. They indicate that 34% of the total forest area in Western Germany are now showing Waldsterben-symptoms. Table 1 demonstrates that the intensity of damage differs widely among the major tree species.

Table 1. Forest area with Waldsterben-symptoms, 1983.

	Millions of hectares	Percentage of total area
Norway spruce (*Picea abies*)	1.194	41
Scots pine (*Pinus sylvestris*)	0.636	43
White fir (*Abies alba*)	0.134	76
European beech (*Fagus sylvatica*)	0.332	26
Oaks (*Quercus robur*, *Qu*. *petraea*)	0.091	15
Other tree species	0.158	17
Total	2.545	34

Item 3

Available German Language Descriptions of Waldsterben

1. Schütt, P., W. Koch, H. Blaschke, K. J. Lang, H. J. Sthuck, and H. Summerer. 1983. So stribt der Wald: Schadbilder und Krankheitsverlauf. BLV Verlagsgesellschaft mbH, Munchen. 95 pp.
2. Rehfuess, K. 1983. Walderkrankungen und Immissionen: eine Zwischenbilanz No. 24:601-610.
3. Various authors. 1983. Allgemeine Forst Zeitschrift 26/27(7):638-699.
4. Ministers für Ernährung, Landwirtschaft und Forsten Nordrhein-Westfalen in der Reihe. Zum Erkennen von Immissions-Schaden an Waldbaumen 1983. "Informationen für den Waldbesitzer" Nr. 12. Allgemeine Forst Zeitschrift München. 16 pp.
5. Anonymous. Walsterben durch Luftverschmutzung. Des Bayerischen Saatsministeriums für Ernährung, Lantwirtschaft und Forsten. München. 20 pp.

OBSERVATIONS OF MONTANE BOREAL TREE DECLINE AND DIEBACK IN THE SOUTHERN APPALACHIAN MOUNTAINS

A statement prepared for presentation to the
United States Senate Committee on Environment and Public Works,
February 7, 1984

by
Dr. Robert Ian Bruck
Assistant Professor of Plant Pathology & Forestry
and
Ms. Sandra Meier, Graduate Research Assistant,
North Carolina State University

Introduction

Red spruce (Picea rubens Sarg.) have died and are continuing to die in unusual numbers in high elevation forests of New York and the New England states during the past two decades. The chronology of these events has closely paralleled those observed in West Germany since the mid-1960's. "Waldsterben", forest death, has been observed in Bavarian forests composed of white fir (Abies alba Mill.) and Norway spruce (Picea abies Karst.). In addition, a general thinning, change in color, and altered morphology of red spruce, white fir, pine, and beech leaves and total tree canopies were observed. Also observed is malformation of leaves (beech) and the active casting of intact green leaves during mid summer months.

Some common threads connect the West German and eastern U.S. observations; the affected forests are located in areas that receive large atmospheric inputs of acidic substances and other pollutants. As a result, considerable attention has been given to the possibility that the atmospheric deposition of acids or other air pollutants may be a cause or a contributing factor in the observed dieback or decline phenomena.

Of particular concern is the possibility that atmospheric deposition of acids, air pollutants, toxic metals, or some combination of these or other stress factors are affecting the trees directly or are causing soil changes that are detrimental, either by removing or adding nutrients to the soil or by mobilizing phytotoxic elements. In addition it is reasonable to assume that already stressed montane boreal forest ecosystems would be highly sensitive to perturbation via atmospheric deposition into shallow, nutrient poor, and poorly buffered soils.

Observations on Mount Mitchell

Mount Mitchell, NC is the highest peak in eastern North America--6,684 feet above mean sea level. It's main peak and three high altitude ridges support large populations of red spruce and Fraser fir which comprise one of the largest boreal montane ecosystems east of the Mississippi River. In the states of North Carolina, Virginia, and Tennessee there are 85 additional peaks and ridges above 5,100 feet in altitude that support boreal forests.

A survey of Mt. Mitchell, NC was conducted from the summit (6,684 feet) to below 5,200 feet during November 1983. The purpose was to characterize and photodocument any decline or die back of red spruce at high altitudes. Soils, surface duff, and tree tissue samples were collected for heavy metal and trace element analysis. Feeder roots of _Picea rubens_ were collected for study of ectomycorrhizal incidence and vigor of mycorrhizae.

Red spruce growing at altitudes of 6,350 feet or higher were found to be in a **severe** state of decline. Trees of age 45-85 years average 75-90% defoliation, characterized by shedding of the oldest needles, leaving a chlorotic tuft of needles at the branch ends.

All trees at or above 6,350 feet elevation **regardless of vigor** exhibit marked growth reduction beginning in the early 1960's. On numerous samples the 21 annual growth increments from 1962-1983 were equivalent in total diameter to the four annual increments of 1958-1961. Precipitation data from 1930-1983 show that at **no time** during these 53 years was there a drought at the summit of Mt. Mitchell. The summit receives an average of 81 inches of rain/year. The lowest rainfall was recorded at 59 inches in 1942 and the period of 1958-1968 averaged over 85 inches of rain/year. We conclude that growth suppression cannot be attributed to lack of moisture.

Spruce stands surveyed below 6,350 feet appear to be healthy and vigorous. There is little, if any, defoliation and thin annual increments of growth were not observed.

Observation and Experiments with Mycorrhizae

Roots of spruce, pines and other needle-bearing trees usually show a symbiotic association with beneficial fungi. These fungus-root structures are called mycorrhizae (myco = fungus, rhiza = root). We observed a statistically significant correlation ($P = 0.05$) between the percent of spruce short roots that are mycorrhizal and the elevation at which the tree was growing. Trees growing above 6,350 feet averaged about 35% mycorrhizal incidence and spruce at or below 5,200 feet averaged about 72% mycorrhizal incidence.

When mycorrhizal incidence was plotted against the degree of decline of the host tree, a highly significant coefficient ($P = 0.01$) was found. Trees exhibiting 80% or more defoliation (spruce at high altitudes) averaged about 30% mycorrhizal incidence, whereas trees with few decline symptoms averaged about 75% mycorrhizal incidence.

High altitude red spruce roots exhibited a far greater degree of disintegration (fine root necrosis) than did the creamy white, fungus mantle covered, tree roots found at low elevation.

Acid-rain simulation experiments in greenhouses at North Carolina State University have demonstrated that incidence and vigor of loblolly pine were severely retarded at pH 4.0 compared to pH 2.4, 3.2, or 5.6 We believe this is the first significant biological effect to be documented at the pH of ambient rainfall for the state of North Carolina.

Mycorrhizal roots of red spruce at low and high elevations on Mt. Mitchell were very similar in appearance and state of necrosis to the pine roots in these rain simulation experiments and were similar in morphology and state of necrosis as compared to the pH 4.0 rain simulation experiments.

Observations on Root-inhabiting Fungi

Root isolations made from declining (high elevation) and non-declining (low elevation) red spruce root tips revealed that at least two species of a fungal root pathogen named Pythium were frequently isolated **only** from the roots of declining trees. Roots of vigorous trees at low elevation failed to yield any pathogenic fungi.

Observations of Forest Reproduction

At altitudes above 6,350 feet we observed **no** successful fir, spruce, or shrub reproduction. The ground was barren of any living woody vegetation. Slopes on the mountain below this altitude were heavily colonized with seedlings and saplings of all age classes By contrast, a vegetation survey in 1958 showed that all Mt. Mitchell slopes from the summit down had lush and abundant ground covers.

Observations of Toxic Metal Accumulation

Lead concentrations in excess of 2 grams per square meter were commonly observed in forest litter at elevations above 6,000 feet. Lower elevations (5,000-5,500 feet) showed considerably less lead loading. It was also found that western-facing slopes (predominant wind direction) had higher lead content. The high altitude soil and litter lead contents are greater than those found in northeastern U.S. mountain samples. Unusually large amounts of Cu, Ni, Zn, and Mn were also detected on Mt. Mitchell, all in amounts greater than those observed from northeastern mountain soils, and in amounts that far exceed those for low elevation forests in North Carolina. The possibility that lead and copper toxicity to plants may exist on Mt. Mitchell must be investigated.

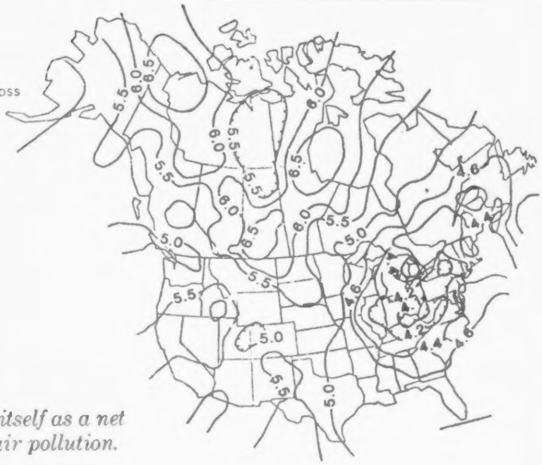
Summary Remarks

Our observations, which suggest that major climatic perturbation (drought, abnormal high or low temperatures) is not of significance in the southern Appalachian mountains, strengthen the hypothesis that atmospheric deposition may contribute or be causal in the etiology of red spruce decline. Some of the possible mechanisms that need to be investigated include:

1. Hydrogen ion deposition inducing aluminum leaching, resulting in root toxicity and tree decline.
2. Calcium depletion from the soil matrix causing deficiency.
3. Nitrogen deposition (averaging about 60 pounds per acre per

year causing nitrogen toxicity, i.e. death of ectomycorrhizae, uptake of excess N resulting in abnormally succulent crowns and shoots and the resulting thinning of cell walls and the reduction of strengthening tissues decreasing the resistance of red spruce to frost, wind desiccation, and fungal or insect parasites.

4. Effects of the abnormally high concentrations of heavy metals in organic matter and soils on root vigor and hence red spruce decline.



1. Distribution of acid precipitation (wet deposition only) across the U.S. and Canada in 1980.

Discovering the causes, consequences, and implications of acid rain and atmospheric deposition

The forest products industry must think of itself as a net receiver rather than a primary emitter of air pollution.

Ellis B. Cowling

The forest products industries of the U.S. and Canada have three major reasons for interest in air pollution, acid rain, and atmospheric deposition and their influences on surface waters and forest productivity:

1. The industry owns a significant part of the forest lands and surface waters into which man-made and natural air emissions of nutrients and toxic substances are deposited on this continent.

2. The productivity of these lands and surface waters, as well as all private nonindustrial and publicly owned forest lands, is determined in part by the balance between beneficial nutrient elements and potentially injurious substances transferred from the atmosphere into forests by wet and dry deposition processes.

3. The industry produces a continentally small but locally important share of the beneficial and injurious gases, aerosols, and particulate matter that are dispersed through the air and deposited on vegetation, soils, surface waters, and man-made structures (*1*).

At present, most forest industry personnel concerned with environmental issues are located at mill sites where the major focus of their concern is with emissions and regulations, rather than with deposition and its effects. For the reasons outlined above, a shift in focus to include research on the chemistry of atmospheric deposition and both beneficial and detrimental effects on forest productivity and water quality is recommended. The forest products industry needs to think of itself as a net receiver rather than a primary emitter of air pollution, acid rain, and atmospheric deposition. The forest products industries will benefit from cooperative research efforts with other industries and with government agencies to better understand the sources of emissions; the transport, transformation, and deposition processes; and the effects of the deposited matter on the land and water resources in various regions of this continent.

From the beginning of life on earth, many plants and animals have obtained an important part of their nutrients from the atmosphere. From time to time plants and animals were injured by toxic gases dispersed in the atmosphere. As the industrial revolution gathered momentum, human beings began to exert more and more influence on the biogeochemical circulation patterns of the earth. We added progressively larger amounts of all sorts of substances to those that circulate naturally among the air, water, soil, and all the living things that inhabit the land and surface waters of the earth. Some of these man-made substances are beneficial nutrients; some are inert; still others are toxic or injurious, depending on their concentration or the nature of the organisms receiving the deposition.

In recent decades, sulfuric and nitric acids were discovered to be prominent among the injurious substances formed in the atmosphere from gases produced during combustion of fossil fuels. Furthermore, these strong acids and certain toxic metals (*2*) were found to be transported over long distances and to have effects on water quality, often at a great distance from the original source of emissions. In certain geologically sensitive regions of northern Europe and eastern North America, acid rain and acid snow were shown to cause direct injury or reproductive failure in fish (*3*). Acidification of ground water was discovered recently in western Sweden (*4*). Rains containing more lead than that allowed by the safe-drinking-water standards have been reported in Pennsylvania (*5*). In recent months, acid clouds and acid fogs have been suggested to be injurious to forests, especially in high mountain regions of the U.S. and Canada (*6, 7*). Widespread death and decline of spruce, fir, and beech forests have been reported in regions of The Federal Republic of Germany, Czechoslovakia, and Poland, where sulfur dioxide pollution has been abundant over many years (*8*). As a result, the terms "acid rain," "acid snow," "acid fog," and "air pollution" have become worrisome

---

Ellis B. Cowling is chairman, National Atmospheric Deposition Program, and associate dean for research, School of Forest Resources, North Carolina State University, Raleigh, N.C. 27650

Reprinted from **Tappi Journal,** The Journal of the Technical Association of the Pulp and Paper Industry.
Vol. 66, No. 9, **September 1983,** Copyright 1983 by TAPPI, and reprinted by permission of the copyright owner.

Item 5 (pg 2)

household words in many parts of Europe and North America. These terms, which have captured the imagination of the public at large, have also stimulated a more deliberate and careful scientific examination of the impact of human activities on the long-distance and short-distance transport of air pollutants, long-term changes in the chemical climatology and biogeochemistry of the earth, and the stability and productivity of ecosystems in the industrial regions of the world (*9*).

The major purpose of this paper is to summarize some important principles concerning the phenomena of air pollution, acid deposition, and atmospheric deposition and their beneficial and detrimental effects on terrestrial and aquatic ecosystems.

Sources and transport of air pollutants

Human activities of many types are changing the chemical climate of North America. Some of these changes are beneficial for agriculture and forestry because they provide valuable nutrients for the growth of crops and trees or accelerate the natural weathering of soil minerals. Other changes are detrimental because they cause stress in plants and animals, alter water quality, aggravate nutrient deficiencies in soils, or accelerate the natural weathering or corrosion of man-made structures and materials. Every industrial nation of the world needs a more complete understanding of the role of human activities in these chemical changes and both their beneficial and detrimental effects on agriculture, forestry, water quality, fisheries, and materials.

Almost everything human beings do on a large scale influences the chemistry of the atmosphere in one way or another. These chemical changes in turn affect the stability and productivity of the ecosystems on which the abundance and the quality of our lives depend. The greatest of all human influences on the chemical climate are combustion of fossil fuels, urban development, and the clearing (especially burning) of forests to make way for agriculture. In industrial regions these activities include the generation of electricity, mining and smelting of metals, industrial processes of many sorts, use of transportation vehicles, space and water heating, incineration and decomposition of sanitary and solid wastes, launching of space vehicles, land clearing and land disposal of industrial and urban wastes, and agricultural and silvicultural operations.

Acid deposition must be understood as one particular manifestation of the general phenomena of air pollution and atmospheric deposition. Precipitation formed in an atmosphere relatively free from man-made sources of contamination theoretically would vary from about pH 4.8 to pH 6.5, depending on the amount of CO_2 and other substances dissolved in the air (*10*). For convenience in discussion, acid precipitation has been defined arbitrarily as rain or snow with a pH below 5.6, even though it is known to vary naturally from about 4.8 to 6.5. The major cations and anions in precipitation which determine the ionic balance and resultant acidity include H^+, NH_4^+, K^+, Na^+, Ca^{++}, Mg^{++}, HCO_3^-, $SO_4^=$, NO_3^-, Cl^-, and $PO_4^{\equiv}$. The principal sources of atmospheric acidity are emissions of sulfur and nitrogen oxides, which interact with moisture in the atmosphere to give high concentrations of H^+, $SO_4^=$, and NO_3^-. Emissions of NH_3 and NH_4^+, although neutralizing of acidity in air and precipitation, become acidifying after they are deposited into terrestrial and aquatic ecosystems.

Deposition of natural and man-made substances from the atmosphere into ecosystems is accomplished by one or more of three processes: (a) absorption or adsorption of gases from the air, (b) gravitational settling and impaction of coarse fly ash and dust particles, as well as fine aerosols, and (c) wet fallout of substances dissolved, suspended, or adsorbed in raindrops, snowflakes, dew, fog droplets, and hail or frost particles. Processes A and B are component parts of so-called dry deposition; Process C includes all forms of wet deposition.

Gaseous emissions of sulfur and nitrogen oxide from combustion of fossil fuels are the principal man-made sources of acidic and acidifying substances in the atmosphere. These materials, which are emitted mainly from power plants, smelters, industrial boilers, and transportation vehicles, are deposited wherever they are carried by winds over urban-industrial, rural, and remote areas.

The states of the U.S. and provinces of Canada vary greatly in the total amounts of their sulfur and nitrogen oxide emissions and in their proximity to acid-sensitive geographical regions. The region in the U.S. with rain and snow of the greatest acidity includes nearly all of the states with very high SO_2 emissions (*11*).

The distance of transport of gaseous emissions leading to wet and dry deposition of acidic and acidifying substances varies from only a few to several hundred or even a thousand miles or more. In general, the amount of atmospheric deposition in any given region is inversely proportional to the distance from major sources, although very strong winds and tall stacks cause some deviations from this generalization. Substantial vertical and horizontal mixing of air pollutants from many different and geographically separate sources occurs during transport over long distances. Thus, the direction of transport often is not the same as the direction of so-called prevailing winds. Because of the great variability of meteorological forces in North America, atmospheric emissions of sulfur dioxide, nitrogen oxides, toxic metals, and other volatile waste products in all states of the eastern U.S. and in all provinces of eastern Canada contribute to the deposition and accumulation of strong acids and other toxic substances in each of the major sensitive regions of this continent.

All emissions of sulfur and nitrogen oxides return to the surface of the earth—either over the continents or over the oceans. We now generally accept that regional changes in emissions of sulfur and nitrogen oxides will result in corresponding (approximately linear) changes in amounts of dry deposition. The extent of expected deviations from linearity for wet deposition will probably vary inversely with the distance from major emission sources and directly with the density of emission sources.

Geographical distribution of acid deposition

Figure 1 contains a map showing the distribution of acid precipitation (wet deposition only) across the U.S. and Canada in 1980. This map was developed by the National Atmospheric Deposition Program (NADP) in the U.S. and by the Canadian Network of Sampling Precipitation (CANSAP) in Canada.

Dry deposition of acidic and acidifying substances is also occurring in large regions across the continent, but little reliable data are currently available on loading rates and geographical trends in various regions. Developing proper methods for measurement of dry deposition is a priority goal of the NADP-CANSAP monitoring programs and the National Acid Precipitation Assessment Program (NAPAP) in the U.S.

The areas receiving highly acidic precipitation (average annual pH between 4.1 and 4.6) include many regions in which surface waters and aquatic life are sensitive to and or are presently being affected by acid precipitation (Fig. 2).

General effects on ecosystems

Significant quantities of plant nutrients, including nitrogen and sulfur, are added to soil in dry deposition and in precipitation. These atmospheric inputs of beneficial nutrient elements are especially important in forests and rangelands where nutrients from other sources are scarce and fertilization by man is not a normal management procedure. Short-term fertilization effects resulting from atmospheric deposition of ammonia and nitrate tend to offset long-term nutrient leaching and other detrimental effects of acid precipitation on forest ecosystems. Negative effects on forest growth are most likely when nutrient deficiencies or imbalances are increased by acid deposition.

Whether the net effect of atmospheric deposition is beneficial or injurious to plants and animals depends on the chemical composition of the deposition (wet and dry), the amount of deposition, the species and genetic characteristics of the organisms on which the substances are deposited, and the physiological condition, structure, and stage of maturity of the organisms.

Regions of greatest sensitivity to acid precipitation usually are recently glaciated, with large areas of exposed granitic (crystalline) and other noncalcareous bedrock and thin soils that are low in acid-neutralizing and cation-exchange capacity.

Effects on aquatic ecosystems

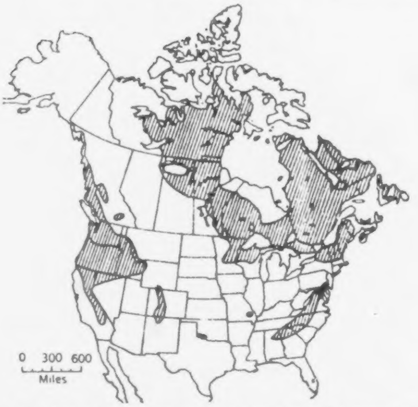
Acids and other soluble substances contained in polluted snow are released as contaminated meltwater during warm periods in winter or in early spring. The resulting release of pollutants can cause major and rapid changes in acidity and other chemical properties of stream and lake waters. Fish kills are a dramatic consequence of such episodic inputs into aquatic ecosystems. Acid precipitation titrates the acidity-alkalinity of lake and stream waters from conditions that are favorable for fish and other aquatic organisms to conditions that inhibit reproduction and/or recruitment of populations of fish and fishfood organisms.

In nutrient-poor lakes and streams between pH 6.0 and pH 5.0, reproduction of certain species of aquatic organisms is inhibited; below pH 5.0, populations of many freshwater fish become extinct. Interference with normal reproductive processes in fish populations is induced not only by acidity itself but also by increased concentrations of certain cations—notably aluminum—in acidified lakes and stream waters. Aluminum compounds vary greatly in toxicity to fish and other aquatic life. In general, ionic forms of aluminum are more toxic than organic complexes of aluminum. Reproduction of frogs and salamanders is also inhibited by atmospheric acidification of surface waters.

As of 1980, many lakes in the Adirondack region of New York State and in parts of southern Ontario and Quebec were showing acid stress in the form of diminished populations or extinction of fish populations. Lakes and streams in other regions of the U.S. and Canada also are vulnerable to stress by acid precipitation. These regions include northern Minnesota, Wisconsin, Michigan, parts of southern Appalachia and Florida, large parts of Washington, Oregon, California, and Idaho, and parts of the Canadian Maritime Provinces (Fig. 2).

Effects on agricultural crops and forests

In certain industrial regions of the world, substantial damage to forests and crops is caused by dry deposition of toxic gases. Ozone, sulfur dioxide, oxides of nitrogen, fluoride, and hydrogen chloride cause serious economic damage to crops and forests; this must be considered together with the possible effects of acid deposition. Recent experiments have shown that acid precipitation predisposes certain agricultural crops to greater damage by ozone.



2. Regions in North America containing lakes and streams that are sensitive to acidification by acid precipitation. The shaded areas have igneous or metamorphic bedrock geology, the unshaded areas have calcareous or sedimentary bedrock geology. Because of the slower geological weathering rates in areas of metamorphic and igneous bedrock geology, we expect lakes in these areas to be dilute and to have low alkalinities (0.5 meq HCO_3^-/L). This hypothesis was tested by compiling lake alkalinity data from several sources. Regions having low alkalinity lakes were concurrent with regions of igneous and metamorphic bedrock geology.

Direct and indirect damage to crops and trees have been reported in laboratory, greenhouse, and field experiments in which synthetic rain equivalent (in chemical composition and rate of deposition) to natural rains has been applied. These biological effects include:

- Induction of necrotic lesions on foliage
- Loss of nutrients due to leaching from foliar organs
- Predisposition of plants to infection by bacterial and fungal pathogens
- Accelerated erosion of waxes on leaf surfaces
- Inhibition of nodulation of legumes leading to decreased nitrogen fixation by symbiotic bacteria
- Reduced rates of decomposition of leaf litter leading to decreased mineralization of organically bound nutrients
- Inhibited formation of terminal buds and increased mortality of pine seedlings.

While specific biological effects of simulated acid rain have been demonstrated in controlled field and laboratory experiments, reliable evidence of damage to agricultural crops, forest, and other natural vegetation, and to biological processes in soil by naturally occurring precipitation has been reported only rarely. Recent experiments in Germany have demonstrated a significant correlation between the amount of soluble aluminum in forest soils, death of feeder roots in spruce and fir trees, and widespread decline in the growth of these forests. Acid precipitation has been postulated as a probable cause of these coincident effects.

Effects on soils

The consequences of acid inputs to soils vary greatly, depending on the rates and recent history of atmospheric acid inputs, the character of the vegetation, natural rates of acid formation in the soil, and the physical/chemical properties of the soil. Soil acidification increases leaching of exchangeable plant nutrients such as calcium, magnesium, potassium, iron, and manganese, and increases the rate of weathering of most minerals.

Acidification decreases the rate of many soil microbiological processes such as nitrogen fixation and breakdown of organic matter. Acidification of soils reduces the availability of phosphorus to plants and increases the solubility of other elements, some of which may be toxic to plants. Aluminum is the most abundant toxic element in forest and agricultural soils. Increasing soil acid leads to greatly increased solubility and toxicity of aluminum to many plants.

Large quantities of hydrogen ions are added to soils, as acid precipitation, as a result of cation-uptake processes and soil-amendment and fertilization practices. Acidification by these processes can be controlled through normal management practices in cultivated soils. However, large areas of North America and Europe are not cultivated and have poorly buffered soils that are susceptible to further acidification. Many of these soils occur in forest and wilderness areas.

Effects on water quality

Chemical composition of lake, stream, and groundwaters is determined, in part, by the chemical composition of precipitation and dry deposition. The chemical composition of precipitation is modified by chemical and biological weathering and exchange processes as the precipitation (a) washes over vegetation, (b) percolates through the soil, (c) interacts with the underlying bedrock of the drainage basin in which the precipitation occurs, and (d) runs over the soil surface.

Acid precipitation increases the solubility and mobility of many cations in soil. This increases the concentration of toxic metal cations, including potassium, aluminum, manganese, and zinc, in the soil solution. It also increases the leaching of nutrient cations, including calcium and magnesium. These toxic and nutrient ions are transferred from soils into surface waters and groundwaters.

Acidification of groundwaters has been found in western Sweden and attributed to long-term changes in the acidity of precipitation. As a result, hundreds of shallow wells and deeper, drilled wells from home and farm buildings have shown acidities in the range of pH 4.0 to pH 6.0. A strong correlation has been found between the acidity of the well water and the content of metal ions, including copper, zinc, lead, manganese, and aluminum. In some cases, accelerated corrosion of copper piping has necessitated the early repair and/or replacement of copper piping systems.

Coordinated research programs

During the last five years, significant efforts have been made in North America to develop well-coordinated programs of research on both the atmospheric and biological aspects of the acid deposition problem. In the spring of 1976, a cadre of more than 100 scientists from various state agricultural experiment stations and other federal, state, and private university and industrial research agencies in the U.S. began the process of creating the organization now known as the National Atmospheric Deposition Program (NADP) to meet the need for a coordinated and long-term research program to monitor the effects of chemical precipitation (Fig. 1).

In the fall of 1977, the President's Council on Environmental Quality contracted with the NADP to draft a "National Program for Assessing the Problem of Atmospheric Deposition (Acid Rain)" (*12*). This document provided the basis for a presidential initiative on acid deposition (*13*), which called for a 10-year program of research on the causes and consequences of acid deposition. The Energy Security Act (PL 96-294), passed by Congress in June 1980, provided a legislative mandate for a national effort. Title VII of this act (the Acid Precipitation Act of 1980) also called for development of a National Acid Precipitation Assessment Plan. The purpose was to develop a firmer scientific basis for environmental- and energy-policy decisions regarding acid deposition. After extensive interagency discussions, a formal proposal was issued in draft form by the Interagency Task Force on Acid Precipitation (*14*) in January 1982. Title VII also authorized additional financial support from Congress for a comprehensive national program of acid rain research. Leadership for this interagency program was vested with administrators of the National Oceanic and Atmospheric Administration (NOAA), the Department of Agriculture (DOA), and the Environmental Protection Agency (EPA).

Summary

We have learned much in recent years about air pollution, acid precipitation, and atmospheric deposition and their effects on public welfare. But we still have unanswered questions about certain aspects of these problems and possible strategies for their solution. Today, public concern about acid rain is at an all-time high in many parts of the world. The recent Presidential and Congressional initiatives in acid rain research in the U.S. have culminated in the formation of a Federal Interagency Task Force on Acid Precipitation and the recently implemented National Acid Precipitation Assessment Program. These initiatives call for a carefully coordinated program of policy-oriented research. Both of these initiatives and the current air-pollution-treaty negotiations with Canada offer increasing hope that the U.S. will do its part, together with Canada, to develop in a timely way the additional knowledge that is needed.

Literature cited

1. Cowling, E.B. and Davey, C.B., *Pulp and Paper* **55**(8): 182(1981).
2. Lindberg, S.E., *Science* 215:1609-1610(1982).
3. Beamish, R.J. and Harvey, H.H., *J. of Fisheries Research Board of Canada* **29**: 113-1143(1972).
4. Hultberg, H. and Johansson, S., *Nordic Hydrology* (12): 51-64(1981).
5. Sharpe, W.E. and Young, E.S., "The Effects of Acid Precipitation on Water Quality in Roof Catchment-Cistern Water Supplies" in *Acid Precipitation Effects on Ecological Systems*, Frank M. D'Itre, Ed., Ann Arbor Science, Ann Arbor, Mich., 1982, p. 365-381.
6. Roberts, L., *BioScience* **32**(10): 778-779(1982).
7. Vogelman, H.W., *Natural History* **91**(11): 8-14(1982).
8. Ulrich, B., "Dangers for the Forect Ecosystem Due to Acid Precipitation, Necessary Countermeasures: Soil Liming and Exhaust Gas Purification". Translation TR-82-0111, Literature Research Co., Annandale, Va., 1982.
9. Cowling, E.B., *Environ. Sci. Technol.* **16**(6): 323A-328A(1982).
10. Charlson, R.J. and Rodhe, H., *Nature* 295: 683-685(1982).
11. Hileman, B., *Environ. Sci. Technol.* **16**(6): 323A-327A(1982).
12. Galloway, J.N., Cowling, E.B., Gorham, E., and McFee, W.W., "A Natural Program for Assessing the Problem of Atmospheric Deposition (Acid Rain)," a report to the Council on Environmental Quality, National Atmospheric Deposition Program, 1978.
13. Carter, J., "The President's Environmental Program 1979," Council on Environmental Quality, Washington, D.C., 1979.
14. Interagency Task Force on Acid Precipitation, National Assessment Plan, Washington, D.C., 1982.

Received for review Dec. 13, 1982.

Accepted March 29, 1983.

Based on a paper in *1983 Annual Meeting Proceedings*, a TAPPI PRESS publication.

Item 6

Four questionable assumptions underlying the Clean Air Act of 1970 and its Amendments of 1977

by
Ellis B. Cowling
School of Forest Resources
North Carolina State University
Raleigh, NC 27650

1) The regulatory procedures of the Act are based on the assumption that individual states can control the quality of air within their own borders. Analysis of the trajectories of air masses in the United States, Canada, and Europe have demonstrated conclusively that distances of transport of air pollutants, particularly those emitted through tall stacks (in excess of 150 meters), are ordinarily of the order of many tens of kilometers, frequently of the order of a few hundred to 1000 kilometers, and occasionally of the order of 2,000 to 10,000 kilometers. From these studies it is apparent that no state can control its own air quality.

   A related conclusion is that air pollutants cross international borders just as freely as they do state and provincial borders. Although there are provisions of the original Act and its Amendments which recognize international transboundary flow of air pollution, the procedures to be used in such cases are slow, cumbersome, and, for the most part, neglected.

   The idea that states should manage their own air quality has certain obvious political advantages and may have been appropriate as a means to control primarily pollutants such as sulfur dioxide. But the idea has very important limitations as a mechanism for management of secondary pollutants such as ozone, sulfate aerosol, and acid precipitation.

2) The regulatory procedures of the Act and its Amendments are based on the assumption that air pollutants occur alone and act on living systems in isolation from each other. The truth is that air pollutants rarely, if ever, occur alone and frequently interact with biological systems additively, synergistically, or antagonistically. Thus, avoidance of harm to human health, plants and animals, soils, water systems, and materials requires that knowledge be obtained and regulatory policies be developed which take into account these multiple-pollutant interactions and their effects on health, living things, and materials.

3) The Act is based on the assumption that "dilution is a solution to pollution". The ambient air-quality standards are described in terms of a dose (concentration of pollutants and time period of

exposure) which has been shown to induce no significant harm, or at least, an acceptable degree of risk to human health, plants, animals, water, or materials. The concept of large-scale titrations of lakes by air-borne acidic and acidifying substances runs counter to the assumption that there is a "safe concentration" or "threshold of tolerance". These underlying concepts need to be examined more carefully.

4) The New Source Performance Standards of the Act require that the emission from newly constructed emission sources be controlled much more stringently than emissions from older facilities. The assumption has been that the older plants would be gradually phased out as these facilities become more and more obsolescent. This phasing out was expected to result in a progressive decrease in emissions. New facilities (with controls in place) would gradually replace old facilities (without controls). These provisions of the Act in effect made the assumption that the amount of reduction necessary to protect public health, ecosystems, surface waters, and materials could be achieved primarily through management of emissions from new sources rather than some combination of both new and older sources. The very large area of North America now receiving acid precipitation and the sizable area within these regions which are sensitive to acid deposition, raise serious question about whether adequate protection against health and welfare effects can be achieved by regulatory strategies that exclude older plants with very substantial sulfur and nitrogen oxide emissions.

Summary:

The Clean Air Act and its Amendments have achieved significant decreases in nearby ground level concentrations of primary pollutants such as sulfur dioxide and suspended particulate matter. These beneficial effects have been especially noticeable in urban areas. At the same time, however, the management procedures commonly used to improve urban air quality have tended to:

1) export pollutants from urban areas to rural and remote areas;

2) increase average residence times in the atmosphere thus providing greater opportunity for chemical transformation of primary pollutants into secondary pollutants such as ozone, sulfate aerosol, and acid precipitation; and

3) greatly increased long-distance transport of air pollutants with resultant export of pollutants to other states, into neighboring areas of Canada and even across the Atlantic to Europe and the Arctic.

ASSESSING THE EFFECTS OF ACID RAIN ON FORESTS OF THE EASTERN U.S.

Testimony Before the United States Senate
Committee on Environment and Public Works

Arthur H. Johnson
Associate Professor (Soils)
University of Pennsylvania, Philadelphia, PA 19104
February 7, 1984

Determining the effects that deposition of acidic substances has had or will have on forests requires an understanding of the direct effects acidic substances have on plants, and the indirect effects which might alter soils or soil-mediated processes. There has been a substantial number of experimental and theoretical research projects which have given us mixed signals about what acid deposition can do. Results of the experimental work indicate that simulated acid rain can have negative effects, positive effects, or no effect on the growth, germination, or resistance to disease of forest trees, but we do not have the appropriate nutritional or physiological information to understand why the effects were observed. We cannot, at present, confidently assess what is actually happening or what might happen in our forests based on the experimental results because we lack detailed process-level information, because the experimental acid applications are not uniform in producing benefit or harm, and because the experimental conditions are simple compared to the complex of factors which controls the growth, reproduction and health of trees in the forest.

We have some interesting results from empirical studies of trends in tree growth and mortality and statistical analysis of the relationship of the growth rate patterns to natural phenomena and to patterns of pollutant emissions and deposition. The results of these types of investigations have shown that in a large number of cases, the growth of forest trees has been substantially less than expected during the past 15 to 25 years, and that in a few cases, mortality has been substantially greater than expected. In relatively few cases has growth been greater than expected. The generalities cited above are the result of data which has been gathered by a number of scientists from measurements of tens of thousands of trees in thousands of plots in 14 states east of the Missisippi. The unexplained reductions in growth and/or increases in mortality have been observed in six or seven coniferous species in Maine, New Hampshire, Vermont, New York, New Jersey, Virginia, Tennessee, North Carolina, South Carolina, Georgia, and Alabama. I hasten to add that the factors which are involved in these phenomena are presently not known; they may be different in different areas, and the role, if any, of acid rain has not been identified.

The findings in North America have been derived from studies of tree rings carried out by many investigators in many locations, and from repeated measurements of tree diameters carried out largely by the U.S. Forest Service. Tree ring studies conducted in central and northern Europe have shown the same anomalous patterns in diameter growth rates in recent decades, followed by alarming incidences of decline and mortality in several species.

Because the changes are substantial (growth rates of 10-40 percent less than expected) and cover broad geographic areas of aesthetically and commercially valuable forests, identification of the cause or causes of these unexpected trends in growth and mortality should be a high priority. Because these changes have been identified in areas receiving moderate to heavy rates of acid deposition, and because the changes occurred during a period when acid deposition has intensified and spread, considerable speculation exists as to how acid rain might be involved. The current state of our understanding based on sound scientific investigations is as follows:

1. **Substantial and easily visible changes in growth have been identified in tree ring studies of some conifers across their ranges in the eastern U.S.** This phenomenon is well documented in 8 states and three species, pitch pine, shortleaf pine and red spruce. Preliminary indications are that this phenomenon is apparent in other species of conifers. The change to abnormally small yearly growth increments is generally rapid and is observed in a substantial proportion of the populations. This change to reduced growth apparently signals the onset of stress, and it occurs after 1955, but in different years in different trees. Trees in all age classes are affected. We have been unable to explain this rather synchronized, regional and long-lasting effect solely on the basis of natural growth-controlling factors such as weather patterns, drought, temperature anomalies, competition, disease, insects, or catastrophic events such as ice storms, hurricanes, etc. It is reasonable to suspect that airborne pollutants alone or in combination with natural stresses could be involved.

2.**Forest Survey data from the Piedmont region of the southeastern U.S. show very clearly unexpected, reduced growth of economically important conifers in the 1970's compared to the 1960's.** These findings are new, and the meaning of this reduction in growth and the factors responsible are not known. The two most important timber species in the South, loblolly and slash pine show inexplicably low growth rates across all of the Piedmont in Alabama, Georgia and South Carolina.

3. **Unexplained, massive mortality has occurred in red spruce in high elevation forests of the Appalachians.** This type of mortality has been documented in North Carolina, New York, Vermont, and New Hampshire, and will likely be clearly identified in other areas soon. Whether or not anomalous mortality has occurred in other species of the high elevation forests is uncertain at present.

4. **The high-elevation forests of the eastern U.S. are subject to extremely high rates of acid deposition, and other airborne substances compared to low elevation forests of the East.** The high rates of input result from high rainfall amounts and prolonged, frequent contact with clouds which cap the mountains. The substances for which we have adequate documentation include sulfuric acid, acidifying nitrogen compounds and heavy metals, particularly lead. Thus by comparison to most of the forests in the east, the remote mountain peaks of the Appalachians are highly polluted environments.

4. **Determining whether or not the mortality in spruce and the anomalous growth trends are related to acid deposition or other pollutants is complicated by several factors.** At this time, no symptoms attributable to a specific pollutant or to a specific type of failure in the plants have been identified. We do not know how resistant the plants or the ecosystems are to ambient doses of the individual pollutants, or combinations of pollutants, or how pollutant and natural stresses interact. We are currently unable to conclusively rule out natural stress as a primary cause in most of the cases.

5. **There is currently no consensus among the scientific community about the involvement of acid deposition in the anomalous growth and mortality patterns observed here and in central Europe.** I stress that there is no clear evidence that acid rain is involved, and there is no clear evidence that acid rain is not involved. It is an open question. I suggest that any political decisions made with our current level of understanding should take into account that recent trends in growth and mortality are, in many cases unfavorable, that these trends have been identified in areas receiving a mix of pollutants including acid rain, and that the sum of the evidence suggests that airborne pollutants are reasonable possiblilities as major contributors. Convincing evidence regarding the involvement of sulfur emissions could emerge from ongoing and planned research, but that evidence is not presently in hand.

ICF INCORPORATED International Square, 1850 K Street, Northwest, Washington, D.C. 20006 (202) 862-1100

September 22, 1983

MEMORANDUM

TO : Alliance for Clean Energy

FROM : Daniel E. Klein

SUBJECT: Analysis of Coal Production and Employment Impacts of the Waxman-Sikorski Bill and a Cost-Effective Equivalent

This memorandum presents ICF's findings of an analysis of the Waxman-Sikorski Bill and a cost-effective equivalent. Special attention has been devoted to shifts in regional coal production and changes in employment in coal mining and transportation.

EXECUTIVE SUMMARY OF FINDINGS

- Three scenarios were examined for a 1995 forecast period. The base case represents a reference case forecast that assumes no acid rain mitigation legislation. The Waxman-Sikorski case is our analysis of H.R. 3400, and represents a reduction of about 9.5 million tons of sulfur dioxide emissions by electric utilities and industrial coal-burning facilities. The cost-effective equivalent case was designed to result in the same level of sulfur dioxide emission reductions as achieved in the Waxman-Sikorski case, but permitted states and utilities free choice to pursue emission reduction strategies in the most cost-effective manner.

- Costs -- The Waxman-Sikorski case results in higher costs to the nation than the cost-equivalent case. The requirements in Waxman-Sikorski would increase the net cost to the nation by about one billion dollars per year (in mid-1982 dollars) relative to the cost-effective equivalent. However, the direct costs to utilities would be significantly less due to subsidy payments.

- Regional coal production -- In the cost-effective equivalent case, fuel switching is often selected as a least-cost means of reducing sulfur dioxide emissions. Accordingly, forecasted coal production tends to decline in higher-sulfur regions such as Northern Appalachia and the Midwest, and increase in lower-sulfur regions such Central Appalachia and the Rockies. Under the Waxman-Sikorski case, there would be a heavy reliance upon retrofit scrubbers as the means for reducing emissions. As such, there are relatively few shifts in coal production relative to base case forecasts, with some regions actually showing an increase in forecasted high-sulfur coal production.

- Employment shifts -- Relative to the Waxman-Sikorski case, the cost-effective equivalent case could result in many jobs shifting from higher-sulfur to lower-sulfur regions by 1995. Relative to 1980 employment levels, the cost-effective equivalent case indicates lower employment levels in higher-sulfur regions such as the Midwest and parts of Northern Appalachia. For the United States as a whole, the forecasted number of jobs in coal mining and transportation shows only modest changes in the three 1995 cases, but appears to be slightly higher in the cost-effective equivalent case than under Waxman-Sikorski.

FRAMEWORK FOR ANALYSES

Cases Examined

In order to evaluate the potential magnitude of the changes in the coal market, we have analyzed three scenarios for 1995:

- The base case represents a reference case forecast that assumes no acid rain mitigation legislation. This is the same base case that was specified by EPA and used in recent acid rain analyses.

- The Waxman-Sikorski case is an analysis of HR-3400 which was performed for EPA, and includes its provisions for mandatory scrubbing at selected plants, scrubber subsidies, sulfur dioxide emission rollbacks, and other requirements specific to this particular bill. In this case, the total emissions of sulfur dioxide by electric utilities in the U.S. is forecasted to be 10.7 million tons in 1995, a reduction of about 9.0 million tons from the 1995 base case. Industrial coal-burning facilities were assumed to reduce sulfur dioxide emissions by about 0.5 million tons through fuel shifting.

- The cost-effective equivalent case was designed to result in the same level of sulfur dioxide emissions in the U.S. as achieved in the Waxman-Sikorski case. However, this case did not provide scrubber subsidies, and did not require specific sulfur dioxide control strategies or emission limits. States and utilities were free to pursue strategies for achieving the required sulfur dioxide reductions in the most cost-effective manner including retrofitting scrubbers, dispatching plants in a least-emissions manner, switching to lower-sulfur fuels, coal blending, and trading of emissions among states. As in the Waxman-Sikorski case, industrial facilities were assumed to reduce emissions through shifts to lower-sulfur fuels.

The Base Case and alternative cases are consistent with previous ICF analyses for EPA. The regional coal production levels are sensitive not only to the acid rain legislation assumptions, but also to the base case assumptions. The base case, initially specified by EPA, may overstate high-sulfur coal production. If so, then production and job losses (from 1980 levels) in high-sulfur regions resulting from acid rain legislation could be understated.

Coal Mining Employment

This analysis also incorporates an improved methodology for estimating employment changes in coal mining. Previous analyses of coal mining employment have relied upon use of historic productivity estimates applied to forecasted regional coal production.

However, the average productivity in 1980 includes production from many metallurgical coal mines which typically have lower productivity than those mines producing steam coals for the industrial and utility markets. Growth in coal demand, as well as shifts resulting from acid rain legislation, will be concentrated in steam coal production. Accordingly, in regions where metallurgical coal production is substantial, use of historic productivity estimates will tend to understate future productivity, overstate future employment levels, and exaggerate shifts (both gains and losses) in mining employment across the scenarios. Further, future productivity in a region could change from historic productivity as a result of changes in the proportion of surface and deep-mined coal, changes in mining technologies, changes in labor practices, and changes resulting from depletion of the more efficient mines.

In recognition of these problems inherent with the use of historic productivity values, we have undertaken the development of an improved methodology for estimating coal mining employment. Specifically, this methodology incorporates the same estimates of coal mining productivity that are used in ICF's Coal and Electric Utilities Model (CEUM) to forecast regional coal production and utility fuel use. In CEUM, coal supply is represented in the form of coal supply curves. There are over 200 coal supply curves, one for each type of coal in each of 40 coal supply regions. Each supply curve is represented as a step function, where each step represents a different type of mine (in terms of mine size, seam thickness, overburden ratio, and other factors). In developing the minimum acceptable selling price for each mine-type on each coal supply curve, the mine costing program in CEUM develops an estimate of productivity in terms of tons per man-day. Using these productivity estimates, we estimated the number of workers associated with the forecasted coal production of any given coal-type and region. In so doing, this improved methodology is able to circumvent many of the problems inherent in the use of historic productivity values.

Coal Transportation Employment

This analysis has also incorporated improvements in the estimation of coal transportation employment. In earlier analyses, changes in coal transportation employment were approximated by the changes in total ton-miles divided by a transportation productivity equal to that of a hypothetical unit coal train.

In this analysis, we have developed estimates of the labor productivity in coal transportation for each mode of transportation represented in CEUM. For example, transportation productivity for water movements of coal were estimated for 13 inland waterways, the Gulf intracoastal waterway, Great Lakes movements, and trans-oceanic movements. These productivity estimates were developed as functions of representative ship or barge size, crew size, average days per worker-year, and average speed. Similar methodologies were used in the estimation of labor productivity in unit train, single-car, and truck movements. In all cases, we have tended to be conservative (i.e., tending toward the low end of the range) in our estimates of the number of transportation workers involved; in particular, we have focused primarily upon those workers actually in motion with the coal and have tended to disregard support labor.

The resulting estimates of transportation labor productivity developed for this analysis can be summarized as follows:

	Ton-Miles Per Worker-Year (millions)	Workers per 10^9 Ton-Miles
Unit Train	53	19
Single-Car Rail	26	38
Trucks	0.6	1,695
Barges	7-52	19-153
Intracoastal Waterway	20-26	38-50
Great Lakes	17-44	23-58
Trans-Oceanic	97-243	4-10

These estimated worker requirements were used with the individual coal movements forecasted in CEUM. In CEUM, there is a transportation route description for coal moving between each origin and destination, by consuming sector. These route descriptions are comprised of mileages by mode of transportation. Using the productivity estimates summarized above, together with the route descriptions and forecasted coal flows, the number of coal transportation workers can be approximated for each forecast case.

POTENTIAL MARKET IMPACTS

The Waxman-Sikorski and cost-effective equivalent alternatives for implementing an acid rain mitigation strategy lead to substantial differences in forecasted retrofit scrubber capacity, coal consumption, regional coal production, total costs, and employment in coal mining and transportation. These changes are discussed below.

Scrubber Retrofits

Our analysis indicates that shifting to lower-sulfur fuels is often less expensive than retrofitting scrubbers on existing facilities as a means of reducing sulfur dioxide emissions. As such, there were only 2.5 gigawatts of retrofit scrubber capacity forecasted under the cost-effective equivalent relative to a 1995 base case without acid rain mitigation requirements. In contrast, the scrubber requirements and capital subsidy provisions of the Waxman-Sikorski case are forecasted to lead to 67.7 gigawatts of additional retrofit scrubber capacity in 1995. See Table 1.

TABLE 1

SCRUBBER CAPACITY UNDER ALTERNATIVE
ACID RAIN MITIGATION APPROACHES
(gigawatts)

	Scrubbed Capacity		Additional Retrofit Scrubbers in 1995	
	1980 Actual	1995 Base Case	Waxman-Sikorski	Cost-Effective Equivalent
Total U.S.	35.5	100.6	+67.7	+2.5

Changes in Coal Consumption

Coal's relative share of future energy requirements in the utility and industrial sector was assumed to be independent of any imposed acid rain regulatory program. Coal as a boiler fuel continues to remain more economic than oil and gas for many fuel applications within the utility and industrial sectors. Particularly in the electric utility sector, switching from coal to oil or gas is one of the least cost-effective emissions control strategies. Other factors such as regulatory, financial, managerial preference, and fuel distribution issues are likely to be more important in determining the relative share of future energy markets for coal relative to oil and gas than will acid rain legislation. Therefore, the total amount of coal consumed by utility and industrial boilers was assumed to remain unchanged under the alternative acid rain mitigation scenarios.

However, the types of coal and oil demanded will shift significantly as some utilities and industrial facilities shift to lower-sulfur fuels to meet emission reduction requirements. Further, the demand for natural gas would likely increase under acid rain legislation because gas can be cost-effectively substituted for oil (though generally not for coal). However, this was not evaluated in this or any of the EPA analyses. Table 2 indicates the changes in forecasted 1995 coal consumption by sulfur level in the U.S. for the utility and industrial sectors.

TABLE 2

CHANGES IN FORECASTED 1995 COAL CONSUMPTION
IN THE U.S.
(10^{15} Btu (quads))

	1995 Base Case	Changes With Acid Rain Legislation: Waxman-Sikorski	Changes With Acid Rain Legislation: Cost-Effective Equivalent
Utility			
Low Sulfur	4.8	+0.2	+3.4
Low-Medium Sulfur	2.7	+0.5	+0.8
High-Medium Sulfur	6.2	-1.5	-1.6
High Sulfur	4.8	+0.9	-2.6
Total	18.5	+0.1	-
Industrial			
Low Sulfur	1.7	+0.4	+0.4
Low-Medium Sulfur	0.2	-0.1	-0.1
High-Medium Sulfur	0.8	-0.3	-0.3
High Sulfur	0.6	-0.1	-0.1
Total	3.3	-	-

Under the cost-effective equivalent case, the shift to lower-sulfur coals is more pronounced, reflecting the greater reliance upon fuel switching as a least-cost strategy. Under the Waxman-Sikorski case, the shift to lower-sulfur fuels is much less pronounced since the scrubber requirements and capital subsidies preclude or reduce the attractiveness of fuel switching. In fact, because of the large amount of retrofit scrubber capacity forecasted under the Waxman-Sikorski case, there would be a significant shift from high-medium sulfur coals to high-sulfur coals by some of the utilities retrofitting scrubbers.

Changes in Regional Coal Production

Consistent with the shifts to lower-sulfur coals by utility and industrial boilers, the cost-effective equivalent case would lead to a shift in the forecasted coal production by region. Table 3 shows coal production by aggregate region for 1995, and also indicates the changes from 1980 to 1995. Supply regions are shown in Figure 1.

Under the cost-effective equivalent case, higher-sulfur regions such as Northern Appalachia and the Midwest are forecasted to have lower levels of production than would have been the case in the absence of acid rain mitigation legislation. Our forecasts indicate 1995 production from these regions as being less than 1980 production levels. Conversely, lower-sulfur regions such as Central Appalachia and parts of the West are forecast to have significantly higher levels of coal production.

Under the Waxman-Sikorski case, there are only slight changes in forecasted coal production relative to the base case. This is because most of the sulfur dioxide emission reductions are attained through scrubber retrofits. As such, there is little shifting to lower-sulfur fuels in order to reduce emissions, and production in lower-sulfur producing regions such as Central Appalachia and parts of the West show little change from 1995 base case levels.

With the requirements and/or subsidies to retrofit scrubbers under the Waxman-Sikorski case, there is less incentive to pay a premium for lower-sulfur fuels at these plants. As a result, our forecasts under the Waxman-Sikorski case also indicate a shift within several of the higher-sulfur producing regions from high-medium sulfur coals to high and very-high sulfur coals.

For this analysis, few shifts to lower-rank coals were forecast. This reflects an assumption that individual boilers designed to burn bituminous coals would not find shifting to lower-rank coals economic after consideration of powerplant modification costs, capacity derates, heat rate increases, and increased costs for flame stabilization. To the extent that such shifts would occur, the estimated cost impacts would be lower, and the forecasted production increases in Eastern and Western bituminous low-sulfur coal fields would be less.

Total Costs

Relative to no legislation, both acid rain mitigation cases would result in higher costs to electric utilities and industry. See Table 4.

In the cost-effective equivalent case, cumulative capital costs by 1995 would increase by 1.5 billion dollars (in mid-1982 dollars) as a result of the acid rain legislation evaluated. This relatively small amount reflects the greater reliance upon fuel switching instead of retrofit scrubbing as a cost-effective means of reducing emissions. Under the Waxman-Sikorski case, the level of retrofit scrubber capacity is much greater. As a result, the cumulative capital costs exceed 21 billion dollars, most of which would be subsidized.

TABLE 3

REGIONAL COAL PRODUCTION[a/]
(million tons)

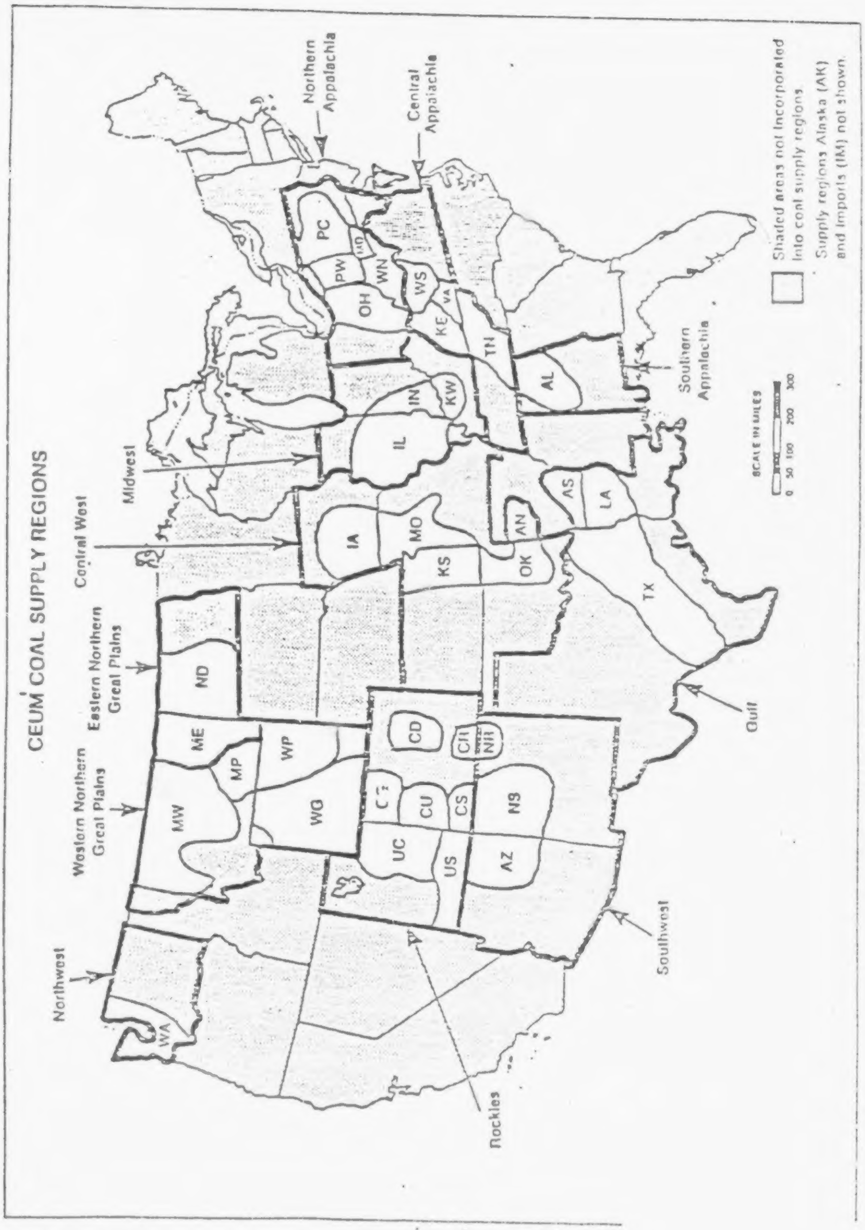
Region	1980	1995			Change from 1980 to 1995		
		Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Effecti Equivalent
Northern Appalachia	185	213	202	157	28	17	(28)
Central Appalachia	233	295	299	350	62	67	117
Southern Appalachia	26	26	26	27	(1)	(0)	0
Total, Appalachia[b/]	444	534	528	533	89	84	89
Midwest	134	182	187	88	48	53	(46)
Eastern Northern Great Plains	17	33	33	33	16	16	16
Western Northern Great Plains	125	250	250	270	125	126	145
Total, Northern Great Plains[b/]	142	283	283	303	141	141	161
Central West	13	23	23	21	11	10	9
Gulf	29	126	126	126	97	97	97
Rockies	32	73	78	133	40	46	101
Southwest	29	61	59	78	32	30	49
Northwest	5	6	6	4	1	1	(1)
Alaska	1	12	12	12	12	12	12
Total, Rest of West[b/]	109	302	305	375	193	196	266
Total U.S.[b/]	830	1,300	1,303	1,299	470	473	469

---

a/ Regional details in Attachment A-1.

b/ Totals may not add due to independent rounding.

FIGURE 1



CEUM COAL SUPPLY REGIONS

TABLE 4

INCREASED CAPITAL AND ANNUALIZED COSTS IN 1995 DUE TO ACID RAIN LEGISLATION
(billions of 1982 $)

	Increases Relative to No Acid Rain Legislation	
	Waxman-Sikorski	Cost-Effective Equivalent
A UTILITY SECTOR		
Cumulative Capital Costs		
Total	+21.5	+1.5
- Subsidy Payments*	+18.0	-
= Direct Cost to Utilities	+3.5	+1.5
Annualized Costs		
Total	+3.8	+2.6
- Subsidy Payments*	+2.1	-
= Direct Cost to Utilities	+1.7	+2.6
B. INDUSTRIAL SECTOR		
Annualized Costs		
Total	+0.4	+0.6
- Subsidy Payments*	-	-
= Direct Cost to Consumer	+0.4	+0.6
C. TOTAL		
Annualized Costs		
Total	+4.2	+3.2
- Subsidy Payments*	+2.1	-
= Direct Costs	+2.1	+3.2

---

* Location of where the subsidy costs are incurred cannot be determined independent of the subsidy financing scheme.

On an annualized basis, the cost-effective equivalent case would entail total annual costs of 3.2 billion dollars (in mid-1982 dollars) relative to no acid rain legislation. The Waxman-Sikorski case would entail annual costs of 4.2 billion dollars (or one billion dollars more per year), half of which would be reflected in the subsidy.

There are a number of uncertainties with respect to the implementation of a subsidy program which could result in either higher or lower differential cost impacts. These uncertainties and the resulting impacts have not been addressed in this analysis.

Changes in Coal Mining and Transportation Employment

The potential shifts in regional coal production as a result of acid rain mitigation legislation could also lead to coal mining job losses in some regions, and gains in other regions. Additionally, coal distribution patterns would also change, leading to employment changes in the transportation industries.

Table 5 summarizes the changes in coal mining and transportation employment in 1995 under the different scenarios. Attachments A-1 and A-2 develop these estimates in greater detail.

-- Coal Mining

Because coal demand is forecasted to grow in all cases, 1995 coal mining employment is also forecasted to grow. Our estimates indicate that the net changes in coal mining employment in both the cost-effective equivalent and Waxman-Sikorski cases indicate a small decline from the forecasted base case national employment levels. The net national job losses under the Waxman-Sikorski case are slightly greater than those under the cost-effective equivalent case.

Consistent with the shifts in regional coal production, the cost-effective equivalent case could lead to shifts in regional coal mining employment. Under the cost-effective equivalent case, production and employment would decline from 1980 levels in higher-sulfur regions such as the Midwest and parts of Northern Appalachia. A forecasted decline is not necessarily the same as forced mined closings and/or layoffs, since between 1980 and 1995 some mines will have depleted their reserves and some miners will have retired.

Forecasted employment levels do not rise or fall proportional to changes in regional coal production, as had been the case in earlier preliminary analyses which relied upon the use of historic productivity estimates. For example, production in some regions (such as Colorado Uinta) is forecasted to rise at a much faster rate than employment levels. This is because much of the current production in these regions is comprised of lower productivity metallurgical mines, whereas the growth in production will largely be in higher productivity steam coal mines. In another example, intraregional shifts in coal production by sulfur content can lead to greater employment

TABLE 5

SHIFTS IN COAL MINING AND TRANSPORTATION EMPLOYMENT
IN 1995 UNDER DIFFERENT
ACID RAIN IMPLEMENTATION PROGRAMS

	Average Number of Workers in 1980 (10^3 Workers)	Change in Employment from 1980 to 1995 (10^3 Workers)		
		1995 Base Case	Waxman-Sikorski	Cost-Effectiv Equivalent
A. COAL MINING[a]				
Northern Appalachia	69.1	+24.5	+17.0	+1.1
Central Appalachia	92.6	+41.3	+44.3	+68.2
Southern Appalachia	11.4	+2.9	+3.0	+3.7
Total, Appalachia	173.1	+68.7	+64.3	+73.1
Midwest	35.1	+17.0	+16.1	-10.1
Eastern Northern Great Plains	1.7	+1.3	+1.2	+1.3
Western Northern Great Plains	6.0	+6.8	+6.9	+8.8
Total, Northern Great Plains	7.7	+8.1	+8.1	+10.0
Central West	2.9	+5.2	+4.8	+4.6
Gulf	1.7	+9.6	+9.6	+9.6
Rockies	7.2	+10.1	+10.8	+23.6
Southwest	2.5	+4.0	+3.6	+8.3
Northwest	0.6	+0.3	+0.3	-
Alaska	0.0	+1.0	+1.0	+1.0
Total, Rest of West	15.1	+30.0	+30.1	+47.2
Total U.S.	231.0	+124.0	+118.7	+120.2
B. COAL TRANSPORTATION[b]				
Transportation Employment	14.5	+10.7	+10.8	+14.9
C. TOTAL, MINING AND TRANSPORTATION				
Coal Mining	231.0	+124.0	+118.7	+120.2
Transportation	14.5	+10.7	+10.8	+14.9
Total	245.5	+134.7	+129.5	+135.1

---

a/ Details in Attachment A-1.

b/ Details in Attachment A-2.

requirements without necessarily increasing total regional production. This is illustrated in regions such as Pennsylvania Central, where total production in 1995 is forecasted to decline from 1980 levels. However, in addition to this forecasted decline is a shift from higher-sulfur coals (which in general have higher productivities) to lower-sulfur coals (which in general have lower productivities). Because of these shifts, average productivity in these regions is forecast to decline from base case levels resulting in a greater number of workers needed to support a lower level of production.

These types of intraregional shifts can be seen in Attachment A-3, where production and employment for an illustrative region (Indiana) are estimated by type of coal and mining method.

- In 1980, most of Indiana's production came from high-sulfur surface mines, with smaller amounts from underground and/or medium-sulfur mines. Stripping ratios ranged from between 12:1 and 25:1 (feet of overburden per foot of coal). Productivity at surface mines averaged about 5,800 tons per worker-year (or about 25 tons per worker-day), covering a range from less than 3,000 to more than 7,000 tons per worker-year.

- By 1995, some of these existing mines will have retired because of exhaustion of reserves. New replacement mines at a given sulfur level would generally have less favorable geologic characteristics, either surface mines which are smaller and/or have higher overburden ratios, or shifts to deep mines. In each case, the productivity of these replacement mines will tend to be less than that of the older, low-stripping ratio mines, thus requiring more workers for a given production level. For example, we forecast that by 1995 new, high-sulfur surface mines would have stripping ratios of about 25:1 and productivity of about 4,000 tons per worker-year (or about 19 tons per worker-day). At these stripping ratios, new deep mines are cost-competitive in seams about five to six feet thick, with a productivity of about 3,000 tons per worker-year (or about 14 tons per worker-day). These deep mines can be cost competitive despite the lower labor productivity because the surface mines are more capital and power intensive. Hence, a shift to deep production as surface reserves are depleted involves lower productivity and more miners, but without a substantial jump in price.

  In the cost-effective equivalent case, the lower production levels lead to fewer new mine openings, thereby slowing the decline in average productivity. However, the relative increase in demand for medium-sulfur coals observed in the cost-effective

> equivalent case leads to a greater shift from high-sulfur to medium-sulfur coals. Such coals tend to be scarcer in states like Indiana, with thinner seams and/or higher stripping ratios. These mines would tend to have lower productivity than most of the high-sulfur mines, and hence require more employment for a given production level. For example, the medium-sulfur coals are forecasted to be from deep mines in seams about four feet thick. Productivity in these mines is forecasted to be about 2,000 tons per worker-year (or about 9 tons per worker-day), which is considerably lower than the 3,000 ton per worker-year productivities forecasted for high-sulfur deep mines in five to six feet thick seams.

This methodology for estimating coal mining employment represents an improvement over earlier methods which assumed constant productivity within a region over time. In particular, this methodology explicitly recognizes differences resulting from coal quality, method of mining, coal geology, levels of preparation, and mine retirements. This methodology is also sensitive to many key assumptions such as the extent and cost of surface-mineable coals and the rates of retirement for existing coal mines. Because information on such parameters is often sparse, employment forecasts must still be considered somewhat uncertain.

Some states include both higher-sulfur and lower-sulfur regions. Therefore, some of the production and employment shifts among regions would be intrastate. For example, shifts out of Kentucky West, a higher-sulfur region in the Midwest, would be offset in part by gains in Kentucky East, a lower-sulfur region in Central Appalachia. Shifts out of West Virginia North (in Northern Appalachia) would be offset in part by gains in West Virginia South (in Central Appalachia).

-- Coal Transportation

The production shifts forecasted under the cost-effective equivalent alternative would lead to greater requirements for coal transportation. As indicated in Attachment A-2, coal transportation requirements would rise by approximately 100 billion ton-miles in 1995 above the levels forecasted in both the base case and Waxman-Sikorski cases. This in turn would lead to about 4,000 additional jobs required for coal transportation, primarily rail and truck movements. Because of the estimating methodology for transportation employment used in this analysis focuses on those directly involved in the coal movements, we believe these estimates are conservative and likely to understate the number of additional workers needed.

-- Related Employment Changes

These estimated changes in coal mining and transportation employment do not include shifts in related industries. In those regions where mining employment losses occurred, there would likely be additional losses associated with the industries supplying those mines and workers. Conversely, there would likely be gains in industries supplying mines and workers in those regions which increased production. Similarly, changes in employment in related manufacturing industries (particularly those for scrubbers and mining equipment) were not assessed. Further, this analysis does not include any changes in employment and/or standards of living associated with the changes in total national costs of meeting coal and electricity demands.

ATTACHMENT A-1

ESTIMATED COAL PRODUCTION AND COAL MINING EMPLOYMENT
IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Supply Region	Production (10^6 tons) 1980	Production 1995 Forecast Base Case	Production 1995 Forecast Waxman-Sikorski	Production 1995 Forecast Cost-Effective Equivalent	Average Number of Workers (10^3 workers) 1980	Average Number of Workers 1995 Forecast Base Case	Average Number of Workers 1995 Forecast Waxman-Sikorski	Average Number of Workers 1995 Forecast Cost-Effective Equivalent	Employment Change from 1980 to (10^3 workers) Base Case	Employment Change Waxman-Sikorski	Employment Change Cost-Effec Equivale
Northern Appalachia											
PC	61.4	56.8	51.6	50.2	22.1	26.7	23.6	23.7	4.5	1.4	1.5
PW	31.7	57.5	53.7	38.4	13.9	28.5	25.6	19.2	14.6	11.7	5.3
OH	39.4	43.2	45.5	19.4	14.7	15.0	16.4	6.9	0.3	1.7	-7.8
MD	3.6	2.9	2.9	2.3	1.1	1.2	1.2	0.9	0.1	0.1	-0.2
WN	40.0	54.2	40.4	46.5	17.3	22.2	19.4	19.5	4.9	2.1	2.2
TOTAL	185.1	213.0	202.2	156.8	69.1	93.7	86.1	70.2	24.5	17.0	1.1
Central Appalachia											
WS	72.7	135.4	140.4	163.5	36.9	70.0	73.2	84.1	33.1	36.3	47.2
VA	41.0	42.7	42.9	49.1	16.1	19.2	19.2	22.7	3.1	3.2	6.7
KE	109.2	106.8	107.6	126.6	35.7	40.4	40.7	49.5	4.7	5.0	13.8
TN	9.9	9.0	8.6	10.5	3.9	4.3	3.7	4.5	0.4	-0.2	0.6
TOTAL	232.8	291.8	299.4	349.0	92.6	133.9	136.9	160.8	41.3	44.3	68.2
Southern Appalachia											
AL	26.4	25.9	26.2	26.5	11.4	14.3	14.4	15.1	2.9	3.0	3.7
TOTAL	26.4	25.9	26.2	26.5	11.4	14.3	14.4	15.1	2.9	3.0	3.7
TOTAL APPALACHIA	444.3	533.6	527.8	533.2	173.1	241.8	237.4	246.2	68.7	64.3	73.1
Midwest											
IL	62.5	72.5	87.1	27.7	17.0	20.5	23.6	7.9	2.8	5.9	-9.8
IN	30.9	46.8	40.1	23.9	5.3	14.0	11.1	6.7	8.7	5.8	1.4
KW	41.0	62.6	59.7	36.6	12.0	17.6	16.5	10.4	5.5	4.5	-1.6
TOTAL	134.4	182.0	186.9	88.2	35.1	52.1	51.3	25.0	17.0	16.1	-10.1
TOTAL MIDWEST	134.4	182.0	186.9	88.2	35.1	52.1	51.3	25.0	17.0	16.1	-10.1
Eastern Northern Great Plains											
ND	17.0	32.7	32.6	32.7	1.7	3.0	3.0	3.0	1.3	1.2	1.3
NE	0.3	0.2	0.2	0.2	-	-	-	-	-	-	-
TOTAL	17.3	33.0	32.8	32.9	1.7	3.0	3.0	3.0	1.3	1.2	1.3
Western Northern Great Plains											
MW		1.7	1.7	1.7	-	0.4	0.4	0.4	0.4	0.4	0.4
MP	29.8	69.1	71.1	81.9	1.1	2.5	2.6	3.0	1.4	1.5	1.9
WP	68.8	129.8	137.7	129.5	2.0	3.0	3.7	3.8	1.0	1.7	1.8
WG	26.1	49.0	39.6	56.5	2.8	6.0	6.1	7.5	3.2	3.3	4.6
TOTAL	124.7	249.7	250.7	269.7	6.0	12.0	12.9	14.7	6.0	6.9	8.7
TOTAL NORTHERN GREAT PLAINS	141.7	282.6	283.1	302.5	7.7	15.0	15.8	17.7	8.1	8.1	10.0

ATTACHMENT A-1 (Continued)

ESTIMATED COAL PRODUCTION AND COAL MINING EMPLOYMENT
IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Supply Region		Production (10^6 tons) 1980	Production 1995 Forecast Base Case	Production 1995 Forecast Waxman-Sikorski	Production 1995 Forecast Cost-Effective Equivalent'	Average Number of Workers (10^3 workers) 1980	Average Number of Workers 1995 Forecast Base Case	Average Number of Workers 1995 Forecast Waxman-Sikorski	Average Number of Workers 1995 Forecast Cost-Effective Equivalent	Employment Change from 1980 to 19 (10^3 workers) Base Case	Employment Change Waxman-Sikorski	Employment Change Cost-Effecti Equivalent
Central West												
	IA	0.6	1.0	1.0	1.0	0.1	0.3	0.3	0.3	0.2	0.2	0.2
	MO	5.5	6.9	6.9	4.4	1.1	1.8	1.8	1.0	0.7	0.7	-0.1
	KS	0.8	3.2	2.3	1.9	0.2	1.1	0.8	0.6	0.9	0.6	0.4
	AN	0.3	5.8	5.8	7.0	0.1	2.7	2.7	3.3	2.5	2.5	3.1
	OK	5.4	6.3	6.4	6.8	1.3	2.2	2.2	2.4	0.9	0.9	1.1
TOTAL		12.6	23.3	22.5	21.1	2.9	8.1	7.8	7.6	5.2	4.0	4.6
Gulf												
	TX	29.4	106.8	107.0	107.0	1.7	8.9	9.0	9.0	7.2	7.2	7.2
	LA	-	14.5	14.5	14.5	-	1.9	1.9	1.9	1.9	1.9	1.9
	AS	-	5.0	5.0	5.0	-	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL		29.4	126.2	126.4	126.4	1.7	11.3	11.4	11.4	9.6	9.6	9.6
Rockies												
	CG	13.7	19.7	22.5	52.4	1.7	2.4	2.9	8.2	0.7	1.2	6.5
	CD	0.4	0.6	0.7	0.7	0.2	0.3	0.4	0.4	0.1	0.2	0.2
	CN	0.9	7.7	8.4	16.5	0.4	2.7	2.9	6.0	2.3	2.5	5.6
	CU	3.0	10.2	11.4	28.2	1.4	3.4	3.7	8.0	2.0	2.3	6.6
	CS	0.1	1.1	1.5	2.1	-	0.2	0.2	0.3	0.1	0.2	0.2
	UC	13.2	32.4	30.6	30.8	3.5	8.2	7.8	7.8	4.7	4.3	4.3
	US	-	0.8	2.9	2.1	-	-	0.3	0.2	-	0.3	0.2
TOTAL		32.1	72.5	78.1	132.7	7.2	17.3	18.0	30.8	10.1	10.8	23.6
Southwest												
	AZ	10.9	16.6	14.9	22.8	0.9	1.4	1.3	2.1	0.5	0.4	1.2
	NR	1.9	7.1	6.3	16.4	0.6	2.3	2.0	5.7	1.7	1.4	5.1
	NG	16.6	37.6	37.9	38.9	1.0	2.8	2.9	3.0	1.8	1.9	2.0
TOTAL		29.3	61.3	59.1	78.1	2.5	6.5	6.2	10.9	4.0	3.6	8.3
Northwest												
	WA	5.1	6.3	6.3	4.4	0.6	0.9	0.9	0.6	0.3	0.3	-
TOTAL		5.1	6.3	6.3	4.4	0.6	0.9	0.9	0.6	0.3	0.3	-
Alaska												
	AK	0.8	12.3	12.3	12.3	-	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL		0.8	12.3	12.3	12.3	-	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL WEST		109.3	301.9	304.8'	375.1	15.1	45.1	45.2	62.2	30.0	30.1	47.7
TOTAL U.S.		829.7	1,300.1	1,302.5	1,299.0	231.0	354.8	349.7	351.2	124.0	118.7	120.2

Note: Totals may not add due to independent rounding.

ICF INCORPORATED

ATTACHMENT A-2

ESTIMATED COAL TRANSPORTATION TON-MILES AND EMPLOYMENT IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

	Ton-Miles (x 10^9)				Average Number of Workers[a/] (10^3 workers)				Employment Change from 1980 to 1995[a/] (10^3 workers)		
		1995 Forecast				1995 Forecast					
Mode	1980	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	1980[b/]	Base Case	Waxman-Sikorski	Cost-Effective Equivalent	Base Case	Waxman-Sikorski	Cost-Effective Equivalent
Rail	N/A	462.2	461.4	557.6	6.1	11.6	11.6	13.4	5.5	5.5	7.3
Barge/Lake[c/]	N/A	68.4	70.0	69.0	1.3	2.0	2.0	1.9	0.7	0.7	0.6
Truck	N/A	9.5	9.5	10.5	5.1	7.4	7.4	9.9	2.3	2.3	4.8
Other[d/]	N/A	644.8	646.1	647.4	2.0	4.2	4.2	4.2	2.2	2.2	2.2
Total[e/]		1,185.0	1,187.0	1,284.5	14.5	25.2	25.3	29.4	10.7	10.8	14.9

---

a/ Because the methodology focuses upon those workers directly involved in the movement of coal, total transportation employment requirements are likely to be underestimated.

b/ ICF estimates for 1980 employment were developed by applying forecasted transportation productivity (by origin-destination and mode of transport) to actual 1980 coal flows.

c/ Over many origin-destination routes, rail-barge and all-rail movements exist. In CEUM, these are generally represented as all-rail. As a result, forecasted barge movements are likely to be understated, and rail movements overstated by a similar amount.

d/ Mostly ocean transportation for exports.

e/ Totals may not add due to independent rounding.

ATTACHMENT A-3

PRODUCTION AND EMPLOYMENT SHIFTS IN INDIANA IN 1980 AND IN 1995 UNDER DIFFERENT SCENARIOS

Sulfur Level	Production (10^3 tons)			Average Number of Workers			Productivity (tons/man-year)		
	Surface	Deep	Total	Surface	Deep	Total	Surface	Deep	Total
1980[a]									
Medium Sulfur	2,113	48	2,161	361	9	370	5,847	5,060	5,827
High-Medium Sulfur	2,415	55	2,470	413	11	424	5,847	5,060	5,827
High Sulfur	10,565	241	10,806	1,807	48	1,855	5,847	5,060	5,827
Very-High Sulfur	15,093	344	15,437	2,581	68	2,649	5,847	5,060	5,827
Total	30,185	688	30,873	5,162	136	5,298	5,847	5,060	5,827
Base Case -- 1995									
Medium Sulfur	2,097	3,443	5,540	626	1,431	2,056	3,350	2,407	2,694
High-Medium Sulfur	2,427	3,440	5,867	751	1,429	2,179	3,232	2,408	2,691
High Sulfur	14,972	3,760	18,732	4,364	1,331	5,695	3,431	2,824	3,289
Very-High Sulfur	11,638	5,025	16,663	2,519	1,516	4,035	4,620	3,315	4,130
Total	31,133	15,669	46,802	8,260	5,706	13,966	3,769	2,746	3,351
Waxman-Sikorski Case									
Medium Sulfur	1,444	3,079	4,524	367	1,262	1,630	3,931	2,439	2,776
High-Medium Sulfur	1,918	3,396	5,314	547	1,408	1,955	3,507	2,411	2,718
High Sulfur	5,818	71	5,890	1,295	12	1,307	4,494	5,827	4,506
Very-High Sulfur	19,392	5,025	24,417	4,676	1,516	6,191	4,148	3,315	3,944
Total	28,573	11,571	40,144	6,885	4,199	11,083	4,150	2,756	3,622
Cost-Effective Equivalent Case									
Medium Sulfur	2,589	3,443	6,033	823	1,430	2,254	3,145	2,407	2,677
High-Medium Sulfur	2,427	3,440	5,867	751	1,429	2,180	3,232	2,408	2,692
High Sulfur	3,478	71	3,549	597	12	609	5,827	5,827	5,827
Very-High Sulfur	8,374	101	8,475	1,634	17	1,651	5,126	5,827	5,134
Total	16,868	7,056	23,924	3,805	2,889	6,693	4,434	2,442	3,574

---

[a] 1980 values are estimates, reflecting incomplete data on production by sulfur level. Data were unavailable to vary average productivity in 1980 across sulfur levels.

ACID RAIN, 1984

THURSDAY, FEBRUARY 9, 1984

U.S. Senate,
Committee on Environment and Public Works,
Washington, D.C.

The committee met at 9:30 a.m., in room SD-406, Dirksen Senate Office Building, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senators Stafford, Durenberger, Humphrey, Randolph, and Mitchell.

OPENING STATEMENT OF HON. ROBERT T. STAFFORD, U.S. SENATOR FROM THE STATE OF VERMONT

Senator **Stafford.** The Committee on Environment and Public Works will please come to order.

Good morning and welcome to all of you for this, the committee's third day of hearings on acid rain. Today's hearing will probably be the longest of the four. We are going to begin by hearing from the three directors of TVA after we have heard from our very able and distinguished colleague, Senator D'Amato of New York, and the most distinguished Governor of Massachusetts, Governor Dukakis, a little bit south of my State.

TVA is the largest utility in the United States and I hope that their firsthand experience will provide the committee with valuable information on what the true costs of an acid rain control program is likely to be.

I would say that I had the privilege of traveling with the directors of the TVA to some of their major powerplants last November and December so that it was possible for the chairman of this committee to have some firsthand experience in noting that emissions of sulfur oxide could be reduced. We had a good chance to see one advanced system of atmospheric fluidized bed combustion in progress and it gave this Senator a feel for the problem and what could be done about it.

We will also hear from industrial and public interest organizations. We may be forced to have some temporary interruption in our proceeding this morning but may I, at this point, invite my colleague, Senator D'Amato, and Governor Dukakis if they care to come to the witness table.

If it is agreeable, gentlemen, while the Governor may be pressed for time, Senator D'Amato has to be somewhere else as soon as he finishes here. In fact, this Senator is supposed to be in three places at once this morning.

Senator D'Amato, we would be very pleased to hear from you.

STATEMENT OF HON. ALFONSE M. D'AMATO, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator D'AMATO. Thank you very much, Chairman Stafford. Let me say how pleased I am to be joined by Governor Dukakis this morning and how fortunate the people of the United States are to have you as the chairman of this important committee. You have demonstrated a tireless devotion to this issue and in spite of some obstacles—obstacles that come from those who should know better—you have persisted. We are knocking at the door for a legislative solution under your leadership, so I appreciate the opportunity to testify on this critical problem of acid rain. Acid rain is destroying our forests, killing our lakes, and it is eating away at our buildings—it has even scarred the Statue of Liberty.

Mr. Stockman says that the issue is unpopular. He wrote a memo called, and I quote, the Politics of Acid Rain, I asked him about this yesterday at the Appropriations Committee. I said, did you really address acid rain with such a memo, and he said, yes. What is the real problem, politics or pollution?

Mr. Stockman says we cannot afford to fight acid rain. I suggest that we cannot afford not to fight it. Once acid rain has wiped out our lakes and our woodlands, it takes decades to restore them. How much is that going to cost? How much will it cost to patch up the corroded monument and clean up the acid waters? One thing for sure, Mr. Chairman, it will cost much more than any acid rain program in the legislative proposals that have been submitted.

Mr. Stockman says we need more research. Now that may be true but it is not really the point. No one needs a scientific study to tell us that we are losing aquatic life in Adirondack lakes. What we need is a program and we need it now. Acid rain has to be attacked at its source, sulfur dioxide as it comes from the smokestacks of coal-fired boilers. Most acid rain bills now in Congress would cut these emissions by 8 to 12 million tons a year. Now this is fine and I am confident that Congress could agree on such a target for reductions. The problem is, however, choosing how are we going to achieve this reduction.

There are two main strategies: switching to coal with less sulfur or installing devices that filter pollutants from the smoke. Both strategies have complications. Most of America's low-sulfur coal lies under the Rocky Mountains, and the Great Plains, so fuel-switching would be a benefit for the Western States. Unfortunately it also might antagonize mining areas in the Midwest and Appalachia. If plants use scrubbers, the can cut emissions and still keep on using high-sulfur coal. But scrubbers cough up tons of sludge, which the General Accounting Office says may be hazardous to public health, if poorly managed.

No strategy is cost free. A single scrubber would account for one-fourth of the $200 million cost of a 1,000-megawatt powerplant. Adapting older plants is even more expensive and shipping low sulfor coal hundreds of miles could hike up the cost as much as $15 a ton. Thus any emission strategy raises the question of who should pay for it. Without some way to spread the cost, 80 percent of the burden would fall on 10 Midwestern and Appalachian States that burn huge amounts of coal.

One proposal for sharing the cost is a nationwide tax on electricity. Such a tax does not credit a State for curbing its own emissions. Since 1970 New York State has greatly cut its annual sulfur dioxide pollution. There is a bill before the State legislature today that would bring about further reductions. New York State residents will ask whether they should pay the same as if they had made no progress at all.

My State already pays the highest residential electric bills in the country, 50 percent greater than the national average. We are more than ready to contribute to a national clean air program but the burden has to be a fair one.

Then the question comes down again, Mr. Chairman: What can Congress do? Senator Durenberger's legislation, which I am cosponsoring, would pass emissions by setting up a 10-year $40 billion trust fund. The Environmental Protection Agency would use the fund to help finance a variety of measures to reduce emissions. What is most promising about the bill is that it simply taxes the polluter and enables EPA to bring about a variety of programs for the conversions that are necessary.

I think the important thing though, Mr. Chairman, is that we get together to work out an equitable program that will curb acid rain. I commend the chairman. I pledge to you that regardless of what you and your committee come up with in terms of the final legislative proposal I will be there to support it. The time is now. We cannot afford to wait any longer.

I thank the chairman.

Senator **Stafford**. Thank you very much, Senator D'Amato. We really appreciate what you said. We will read much of it and your help before this committee will be greatly received whenever we go before the Senate. Knowing how busy you are, we would invite you to stay but if you feel that you should leave, we understand that also.

Senator **D'Amato**. I certainly appreciate it, Mr. Chairman.

Senator **Stafford**. Senator, before you leave, I should tell you that Senator Durenberger wanted to be here for your statement but he is unavoidably detained by another important matter. He wished to make sure that you knew that.

Senator **D'Amato**. Thank you, Senator.

Senator **Stafford**. The next witness is the most able Governor of our neighboring State, the Commonwealth of Massachusetts. Governor Dukakis, we are delighted that you are able to be with us this morning and we look forward eagerly to your testimony.

STATEMENT OF HON. MICHAEL D. DUKAKIS, GOVERNOR, STATE OF MASSACHUSETTS

Governor **Dukakis**. Thank you very much, Mr. Chairman. It is a very great pleasure to be here with you and join you and Senator Mitchell and others in dealing with this issue.

I have a fairly extensive statement which I filed with the committee and I don't want to take your valuable time to read it. What I would like to do is simply highlight a few points and then respond to any questions you may have.

Senator **Stafford**. Governor, we would be very happy to put your entire statement in the record and then have you summarize it any way you wish.

Governor **Dukakis**. Thank you very much, Senator.

Mr. Chairman, as you know, I was not invited to the White House to participate in the conference that the President had with some of the Governors but I understand from one of my colleagues who was there that the President asked whether or not this matter was an emergency and I simply want to say to you and Senator Mitchell and put on the record the fact that at least in my State it is an emergency. It is an emergency because we already have lakes and ponds on Cape Cod which are literally biologically dead or virtually dead. According to a very extensive study and analysis that was done under the direction of Prof. Paul Godfrey of the University of Massachusetts 20 percent of our lakes and ponds in the Commonwealth of Massachusetts are seriously endangered.

It is an emergency because at this very moment we are spending over $1 million of public funds to treat the Quabbin Reservoir which is the principal source of water for Metropolitan Boston for fear that if we do not that water which is becoming increasingly acidified will leach lead into the pipes that carry water to the people of my capital city and our metropolitan area and we are also lining other ponds and lakes at this very moment in the Commonwealth of Massachusetts to avoid similar kinds of damage.

So for us it is an emergency, and although we have reduced the amount of sulfur that goes into the air from Massachusetts sources by 40 percent in the past 10 years and are continuing to do so, as I will explain in a minute, this is one of those problems which a State as you all know simply can't handle all by itself. If we could, we would do it no matter what the cost, I can assure you of that.

So we are here with a number of you who have provided great leadership on this issue in the hopes that this year we can finally have the kind of broad, comprehensive, effective, and fair acid rain legislation that we have needed for a long time in this country.

One of the things that we have tried to do is to provide some leadership in developing the concept of cost sharing which as you know is the heart of the Coalition of Northeast Governors' proposal. We have done so because we recognize that there are a series of economic problems in the Midwest and Appalachian States, that even though they may well be the principal source of this stuff that they need help even as we did in New England back in the forties, fifties, and sixties when our industrial base collapsed under us. So we are proposing a combination of a nationwide tax on electricity and a tax on emissions which we think is the best blend of both proposals in a way that will provide equitable national cost sharing and yet at the same time ask those who are producing most of this stuff to carry some of the burden.

I just would like to note two other things before concluding my testimony and taking whatever questions you might have. First the issue of what happens to the States that are today producing a great deal of high sulfur coal and depend very heavily on it for their economic strength. It is our feeling that the kind of cost sharing that we are proposing in the CONEG proposal will go a long way toward dealing with those fears, and they are legitimate ones.

Why? Because it will subsidize a very substantial part of the cost of whatever technology is required to clean up the high sulfur coal that is involved.

I would simply point out to you, Mr. Chairman and members of the committee, that recently, and I would like to file a copy of the letter that I am going to talk about in a minute, the Boston Edison Co., which is our principal utility in the Boston metropolitan area, has agreed as part of a proposal for converting a major oil-fired plant in South Boston from oil to coal, to use scrubber technology, and expensive scrubber technology, as a part of that conversion. In doing so they will actually reduce emissions from a generating plant which currently burns 1 percent sulfur oil to the equivalent of 0.3 sulfur oil which is effectively the quality of distillate oil coming out of that plant as part of that conversion. This is one of a number of conversions which has either taken place or is taking place or is already underway in Massachusetts from oil-fired to coal-fired generation.

So I would say to our friends from the coal States and representatives of the coal industry that we not only recognize our responsibility, we are in the process of shifting rather dramatically from oil to coal in the way we generate electricity and we are doing so in a way which in fact is further reducing the amount of sulfur that is going into the atmosphere with an expensive but necessary technology. If we are doing it in Massachusetts, it seems to me that under a reasonable proposal which includes cost sharing there is no reason why the same process can't take place elsewhere.

Now these are just some of the things that I wanted to emphasize to you. All of these and others are contained more extensively in the statement that I have filed with you.

Let me just conclude by saying again to you that as Governor of the State that has some of the most dangerous acid precipitation in the country and one whose water bodies are less resistant to acidification than most others for we have very little buffering capacity in many of our lakes and ponds, I would simply not only urge you but plead with you to give us the kind of legislation which we desperately need if we are going to deal with this problem effectively. We will do everything humanly possible to deal with it in our State but we need your help.

Our Canadian neighbors, as you know, need our help and apparently are going to be filing some kind of a formal diplomatic protest in the next few days which is really a pretty sad testimonial to our failure to respond as a nation.

I look forward to working with both of you and Senator Stafford, and I know you have provided greater leadership on this. Both I and Mr. Cortese who is our commissioner in the department of environmental quality engineering in Massachusetts on this are available to you and we would be happy to supply you with any information or help you with that and do the best we can. Let me also say that I, along with many of my fellow Governors, will be doing anything we can to persuade a substantial majority of the Governors in the Coalition of Northeast Governors to support a good, strong resolution and I hope that, too, will be helpful to you as you work with us and we with you to deal with the problem.

Thank you very much, Mr. Chairman. If you do have any questions, I would be happy to respond.

Senator **Stafford**. Senator Mitchell, do you have a question?

Senator **Mitchell**. Thank you, Mr. Chairman.

Governor, let me commend you on your statement and on the very effective and forceful leadership you have exercised in this area. Coming from New England I, perhaps more than other members of the committee, am aware of your interest and the effort that you have displayed in this area.

Let me ask you a specific question which relates your proposals—that is, the Conference of Coalition of Northeast Governors—to interest expressed by other Governors. Just 2 days ago, almost exactly 48 hours ago, four of your colleagues sat at the table that you are now sitting at. Among them were Governors Matheson of Utah and Schwinden of Montana. They were very persuasive and forceful in their testimony as you have been and the thrust of their argument, of course, was that they have already expended enormous sums in installing the type of technology you have talked about in Boston and have achieved levels of reduction of emissions which, if the rest of the country did it, would mean we would not have a problem, we would not have to be here, and they are understandably opposed to any cost-sharing mechanism that would impose costs on their consumers who already are paying large sums and therefore are not contributing to the problem. Now obviously that is one of many areas in which there are different economic interests in different regions of the country.

My specific question to you is this. Although, as I understand it, the proposals of the Coalition of Northeast Governors does not include a credit for past but the very least recent expenditures in this area, would you be willing in the process of considering this to think about adding that as part of your cost-sharing proposal so that these States, especially those which have very recently expended very large sums of money, would be given some credit for that in the calculation of the method by which the trust fund is funded?

Governor **Dukakis**. We are prepared, Senator, to work with you and the other Governors of the United States on this whole range of issues. There is no right answer here as I think you know. Mr. Cortese has just handed me a note saying our proposal effectively does what those Governors are asking us to do in any event by exempting plants which are substantially below a certain level of emission as it is. On the other hand, those of us in New England who have not only spent great sums on this but are actually paying electric rates substantially higher than virtually any other part of the country could generally take the same position but this is one nation, at least I believe it is, and we have to work together. Our taxes, I believe, go to pay for an awful lot of water projects in the West which really have very little direct benefit to us and yet those are funded out of the national treasury and while we may occasionally complain, we do so and have done so because we feel we have a responsibility as a Nation to help in the development of water resources in the western part of the country. I think it is very significant that the staff advisory committee to the Western Governors recently unanimously recommended that their Governors support a proposal very much like the CONEG proposal.

So I think we are making some real progress but I do think our proposal goes a long way toward dealing with the issue of the States that have cleaned up their act early by crediting them with that action. We will be working with them and with you across the entire spectrum but I think we will try to meet that objection.

Senator Mitchell. Well, it is very important to understand that there are a wide range of conflicting interests here, some of which may be irreconcilable. There is, however, included within that a narrower range of interest which may be reconciled. I am talking now about these Governors' strongly supported legislation, they had a more important message to convey in terms of the method of implementation of the act but on cost sharing they are understandably and justifiably concerned about the interests of the people of their State and I think it is very important to identify the broadest possible base of interest which can be reconciled in support of the bill.

There are many people who come in here, I have met with—I am going to estimate—50 or 60 different groups who will come in and urge changes in the legislation and I ask all of them this first question: If we make that change, will you support the bill? Oh, no, they say, we will never do that but we still think you should make the change. I think those who are willing to say yes to that question that we ought to try to accommodate them and that is the point I was trying to make.

We are not going to be able to please everybody if we pass the bill because some people don't want a bill to be passed, that is the only way they would be pleased. But the Western Governors, it seems to me, and the Western Senators do have a very legitimate, justifiable, and very understandable concern which I think we in the East must be prepared to accommodate if for no other reason than to gain their support for legislation.

Governor Dukakis. We agree and I think we are moving in that direction already and I hope to have some good news for you.

Senator Mitchell. Thank you, Governor. Thank you again for your very forceful and persuasive statement.

Senator Stafford. Thank you, Senator Mitchell.

Senator Durenberger, do you have any questions?

Senator Durenberger. Yes.

Governor, let me take George's question one step further. You are speaking for a coalition of Governors. Let me ask you to describe the financing mechanism in the coalition. I understand it is a mix of electricity tax and emissions taxes, not less than 50 percent of the emissions taxes, but I would like to know if you could describe that just a little bit further and also describe the considerations that went into putting it together. That is, why did you come up with that particular solution? That might be informative since we are looking for a variety of ways.

Governor Dukakis. I think you are familiar with the proposal itself, Senator, and the concept of the combination of taxes on electricity nationally and taxes on emitters, no more than 50 percent of which would be on electricity and the provision that the fund would be used to pay up to two-thirds of the capital improvements required to clean up the situation in these plants and sources. There are other aspects of it as well which I think you are familiar with. The considerations, quite clearly, were to try to respond positively to some of the concerns that we heard, and they are legitimate concerns from those who spent a lot of money to clean up their act already from States like Senator Randolph's that are running on 50 percent as it is and depend very heavily on the mining of coal and related kinds of activities for their economic future and for jobs for their people and also to recognize that if this is a national problem, and it is, that we all deal with the responsibility to contribute even if we happen to live in a State that may be doing better.

I agree with Senator Mitchell. I think we have to deal with every broad coalition behind this bill, I believe we can, but it was the combination of those factors and our desire to try to be fair, particularly to a region of the State that is in very deep trouble going through a terrible recession, and frankly from the standpoint of those of us in New England because, as I said earlier, we went through the same kind of thing the Appalachian States and Western States are now going through 23 or 24 years ago to try to reach out and help even as we were dealing with the problem that was facing us.

Senator **DURENBERGER**. The point of the question, Governor, collectively you came to a judgment on the need of financing this project.

Governor **DUKAKIS**. Yes, sir.

Senator **DURENBERGER**. My colleagues here have a piece of legislation that has already been through this committee on a 15 to 1 vote and I am the cosponsor of it this time around and we don't have a financing mechanism. They have a mandate and they lay this out among the States. Now they have come, at least the two of them on either side of the Senator from West Virginia, and represent the same kinds of constituencies that the organization represents. Why do you come to the conclusion as Governors representing those State constituencies that you have to go a step beyond where they are with a financing mechanism to make this thing work?

Governor **DUKAKIS**. Well, one thing, I got beat in 1978 and I learned a few lessons in trying to put workable coalitions together so things are a little better at least in Massachusetts but after listening, as I am sure you have—and Senator Mitchell and Senator Stafford and I have talked about this—after listening very carefully to colleagues from the West and colleagues from the Midwest and colleagues from the Appalachian States and discussing this with all of them and others, it was very clear to us that, unless we could develop a consensus around cost sharing, we were not going to go anywhere. Since we are not getting any leadership to speak of from the executive branch, this becomes uniquely a kind of coalition and consensus building effort and because I think it is fair and because we do have a responsibility to the States that are flat on their backs during this recession this is what we came up with.

I might add we started that. A week or two after I was elected I sat down with my Lieutenant Governor and some of our environmental people. I said, look, we have to somehow respond to the legitimate concerns on the part of people that happen to represent States and constituencies other than our own. We cannot say it is your problem, you pay for it because you produce it, and I think it is out of that process that we have developed this notion of cost sharing and try to be responsible.

Senator DURENBERGER. Let me ask you one other brief question on that. One of the areas that your approach has in common with the Mitchell-Stafford approach is that you put a lot of reliance on the States, you put them in charge of this so-called emergency that we have, allocate reductions to States and let them pick out specific polluters.

Governor DUKAKIS. Yes.

Senator DURENBERGER. If we have the financing mechanism, then we would just block the money back to the States. My question to you, as a Northeast Governor, have you looked at the State of Ohio and its performance under the Clean Air Act to see whether or not you would trust the State of Ohio to solve the problems of the Northeast? Second, don't you think that this related question, the State-by-State approach to the allocations really is in conflict with the least cost which is one of the principles that I salute the Northeast Governors for having come up with? Why not just let EPA pick the cheapest kind of a national program?

Governor DUKAKIS. Let me say with respect to your first question, I talked with Governor Celeste and I sympathize with him because he has a lot of the same problems I had in the mid-seventies with respect to financial management. While I have not looked in detail at what Ohio has or has not done, it is pretty clear that other States have done more and yet I have enough confidence in him and the people of Ohio and, assuming we can put together a cost-sharing mechanism that helps, I believe that they will do the job and do it well. I know he wants to but he is very sensitive to the economic impact in the State and so would I be if I were in a State that had difficulty on the economic question.

Senator DURENBERGER. I don't want to belabor the point but by way of illustration this is a problem that lies before us. The criticism of the national approach in the emissions bill is that nobody trusts EPA. My criticism is sometimes we don't like who runs EPA. My problem is should I trust 50 EPA people out there to solve a problem that is an emergency and it is getting desperate. I ask you that because I think it is a question that we all have to deal with. There are no easy answers to it but I think it is an important question to those of us in this room right now who happen to be very committed to solving the problem.

Governor DUKAKIS. I agree and let me answer it very directly. In our proposal if the States do not act in 18 months then the EPA is going to be part of the setup. So what we are doing is giving a State, say, a reasonable period of time in which to act. I think on the record the States have done pretty well in the clean up of air and water under this kind of a joint Federal-State situation but we are sensitive to that and that is why the provision is in the bill and I strongly support it.

Senator DURENBERGER. Thank you.

Senator STAFFORD. Thank you very much, Senator Durenberger.

Governor, again we appreciate your being here not because of the concept that the CONEG Governors reached on trying to deal with this problem and knowing, I think, that Vermont should be part of the CONEG and I don't know why it isn't but I should point out that Vermont is not currently part of CONEG so that our Governor didn't participate in the deliberations that led to the resolution.

Senator Randolph.

Senator **Randolph**. Governor, the coalition of which you are the titular head as Governor of Massachusetts, for the record again would you list the States that are in such a coalition?

Governor **Dukakis**. I am doing it from memory, Senator.

All of the New England States support this even though Vermont is not officially a member of CONEG because in the Conference of Governors we have endorsed essentially the same kind of legislation and we have been joined by New Jersey, New York, and Pennsylvania. I just wanted to add that because Governor Snelling has been very supportive of this approach as a member of the New England Governors.

Senator **Randolph**. Does that add up to eight States?

Governor **Dukakis**. I think it adds up to nine.

Senator **Randolph**. Including Pennsylvania?

Governor **Dukakis**. Pennsylvania has some reservations in terms of timing so it is eight States that clearly support it and one that does so with a reservation but in my opinion not serious.

Senator **Randolph**. I feel that in coming together as you have done was a realistic approach. State by State it could never be done; isn't that correct?

Governor **Dukakis**. That is correct.

Senator **Randolph**. It must be done with an understanding of the problem that stretches across the Nation, and you are concerned enough that you take this approach certainly causes me to commend you. There are considerations that must be clearly understood and these cross a large spectrum of situations that would concern Pennsylvania or West Virginia or any other State in the Union. So this morning for the record, Mr. Chairman, I want to express appreciation to the Governor and those that have joined with him. You did not arrive at what you have now through a hit-and-miss approach to this subject, you have tried to understand the concerns, to recognize your commitments, and hopefully from this committee whatever we do, whatever the Congress may do, that it will be one of considered judgment and, may I add, not enacted in haste. Would you agree with me on the last?

Governor **Dukakis**. Senator, my State faces critical problems at this very moment and every day and every week and every month that goes by adds to those problems so for us this is really an emergency.

Senator **Randolph**. An emergency.

Governor **Dukakis**. Yes; but if you can identify, and I know you can, for us some of the problems that you may have with the draft, we will be happy to go back and take a look. Again this is a very delicate coalition balancing act as Senator Mitchell pointed out but we have some very bright, resourceful people who are extremely creative on this and with your special perspective, if you can identify some of the problems you see. I mentioned before you came in we are doing another conversion in Boston and we will be using scrubbers and we will end up with a plant that not only burns a lot of coal instead of oil but burns it more cleanly by a very substantial margin in agreement with what we are currently burning so we are going to try to help western Pennsylvania and West Virginia and at the same time do it in a way that is clean. I think we can work together with it but it is a very urgent matter for us, very urgent.

Senator **Randolph**. We go on assumptions so often. I always thought Chicago was a windy city. Well, I find you have more aggressive winds in Boston than you have in Chicago so I am a learner in that sort of situation and all of us must be that. Thank you very much.

Governor **Dukakis**. I appreciate it.

Senator **Stafford**. Thank you, Senator Randolph.

Senator Mitchell.

Senator **Mitchell**. Governor, I wanted to make a point that really was stimulated by Senator Durenberger's question and relates to what I said earlier. You are making what I think is a commendable good faith effort to accommodate the views of those who would be affected by this legislation by supporting a national trust fund and you do it in an effort to build the coalition sufficient to gain enactment of this legislation. In so doing, of course, you jeopardize the support of others who support legislation but not a national trust fund and I think you have to make some calculation on whether the gains are justified in light of the losses and so I would urge you, in discussing this among the Governors, to find out from the Governors of the Midwest whether they would support legislation of the type you propose.

We are going to have a pretty good indication. Just after you finish we are going to have representatives here from the Edison Electric Institute and National Coal Association and I know they are sitting in the room so I will prepare them for the question I am going to ask them, whether they, who have consistently opposed the legislation, would support the legislation of the type that you now propose and I think that is a critical question that you as a leader of the East must find out from the Midwestern Governors.

We invited all of the Midwestern Governors or several of them to come here and they declined the invitation. It would have been a very important bit of information for us to learn what their attitude is toward this legislation because if their position is go ahead and make the change but we are against the bill anyway, in the meantime you lose votes out in the West, you have not built a coalition, you have reduced the coalition, and I think the critical political question is to what extent will this add support to legislation now and I know you are going through that right now with the Governors' Conference.

Governor **Dukakis**. Yes.

Senator **Mitchell**. We need to know that in the process of marking this bill up in the committee.

Senator **Durenberger**. George, if you will yield briefly on that point, part of the answer is already in the House bill. The first bill had 115 political cosponsors, most of whom represent the Midwest, so the debate the Governor has to face is not so much whether there ought to be a trust fund or not but where the money comes from.

Senator STAFFORD. Thank you, Senator.

Governor, again thank you very much for joining us here this morning. As I understand it from some of your colleagues from the West yesterday who we gathered supported the current committee working paper, the National Governors' Conference undoubtedly will come to a resolution on this matter, we will look forward to hearing what it is as soon as possible and some of the conflicting eddies of current here may be resolved there amongst all of the 50 Governors.

What encourages this Member about the whole situation is that 2 years ago this committee was almost alone in trying to write legislation to deal with the acid rain problem, now at least most of the country is concerned about it and many parts of the country as the New England Governors and the CONEG Governors are preparing proposals to deal with it, so I am encouraged with everybody now recognizing that we need to do something about it and most of us believing we need to begin to do it now as you do in your State. The time is approaching when I think something will be done about it and I am encouraged by that and by your testimony.

Thank you very much.

Senator MITCHELL. Mr. Chairman, could I just make one further comment if I may?

Senator STAFFORD. Yes, sir.

Senator MITCHELL. I think it is important to make the distinction between the Waxman-Sikorski bill and the bill that the Northeast Governors have supported. There is a very major difference which is that Waxman-Sikorski would fund the national trust fund exclusively through a uniform national tax on electricity and this would fund it half by a tax on emissions. That is a very major difference that I think ought to be explored.

Senator DURENBERGER. I applaud the distinction.

Governor DUKAKIS. Yes.

Senator MITCHELL. I do, too, but I don't think that you can gage the response of this legislation by the response to Waxman-Sikorski.

Thank you, Bill.

Senator STAFFORD. Thank you very much, Governor.

Governor DUKAKIS. Thank you for your leadership because you were there way ahead of others and you have really given us the impetus to do what we are doing. We will be in very close touch with you and I hope we can accomplish the same thing before you go home.

Senator STAFFORD. We will work together.

Governor DUKAKIS. Thank you.

Senator STAFFORD. The next panel will be the Chairman and co-Directors of the Board of Directors from the Tennessee Valley Authority, Mr. Charles Dean, the Chairman of the Board; Mr. David Freeman, a Director; and Mr. Richard Freeman, a Director. I understand the Freemans are not related but bear the same name and have gotten along well for the last few years on the Board of Directors.

Gentlemen. Mr. Dean, would you go first and speak for the Board?

STATEMENT OF CHARLES H. DEAN, JR., CHAIRMAN, BOARD OF DIRECTORS, TENNESSEE VALLEY AUTHORITY, ACCOMPANIED BY S. DAVID FREEMAN, DIRECTOR, AND RICHARD M. FREEMAN, DIRECTOR

Mr. DEAN. Mr. Chairman, with your permission, we have excerpted our testimony that we will file with the committee.

Senator STAFFORD. We have the testimony on behalf of the Board, we would like to place that in the record and advise you to proceed in any way you wish.

Mr. DEAN. I will keep this relatively short.

We are certainly pleased to be here today in response to your invitation to present our views on one of the most serious environmental problems facing this and future generations.

Because of our multifaceted mission, TVA has a unique perspective to share with you as you decide what action to take. TVA is a corporate agency and instrumentality of the United States; the Nation's largest producer of electricity; one of the Nation's largest coal consumers; and one of the largest emitters of SO_2, the pollutant which has been most often identified with formation of acid rain. We are also responsible for helping protect the waters and forests in the Tennessee Valley, for stimulating economic development in the Tennessee Valley region, and for promoting the wise use of its natural resources—responsibilities that go far beyond producing power. TVA has over 50 years of experience in reconciling apparently conflicting interests and solving interrelated energy and environmental problems.

As a federally owned producer of electric energy, TVA believes that its role is to serve as a leader in the electric utility industry in seeking solutions to national problems. We have often been successful in combining our special responsibility to pursue a broader public interest with our technical, real-world-of-business perspective and bring them both to bear on public issues such as acid rain. It is in this spirit that we offer our observations.

TVA is not in accord with the program of the President. Our position represents the opinion of the TVA Board. Simply put, our position on acid rain is that a reduction in acid precursors is essential in eastern North America and that Federal legislation is necessary to accomplish this. Reductions should be required of all significant emitters of SO_2, both utilities and other industries. These SO_2 reductions should be allocated to the States proportionally to their total SO_2 emissions for the 1980 base year. States should have flexibility in allocating their required emissions reductions.

TVA believes in the principle that the polluter should pay, and we practice what we preach. The costs of further reduction should be borne by the polluters and thus passed on to consumers. Maximum flexibility should be given to emitters to select the most cost-effective way to reduce their emissions. If acid rain legislation is structured in this way, we estimate the increased cost to TVA ratepayers could be about 4 to 6 percent for our share of a 12-million-ton national reduction. We stand willing to do our fair share in any cleanup effort.

Acid rain is too often thought of as a regional problem, confined to the Northeastern United States and eastern Canada. However, we have rainfall in the Tennessee Valley which is as acidic as that found anywhere in North America. Based on a monitoring program which began in 1971, we know that on an average annual basis our rainfall is in the pH 4.1 to 4.4 range—typical of the values for New England, and we get much more rainfall than New England.

While we have no direct evidence of a link between acid deposition and impacts to resources in our region, several observations over the last several years could be related to acid deposition. The printed statement gives information on these observations and on the TVA acid rain research program.

Mr. Chairman, we also have an additional document which is fairly new which we will be happy to submit for the record if you care to have it.

Senator STAFFORD. We would appreciate it if we could have it; we will put it in the record. (See p. 322.)

Mr. DEAN. TVA has just completed the largest air pollution cleanup effort by a single emitter in U.S. history. In the past 6 years TVA cut its SO_2 emissions by 56 percent, from 2.3 million to 1 million tons per year, and particulate emissions by 100,000 tons or over 90 percent. The total investment so far has been $927 million. The annualized cost is about $346 million in 1984 dollars. The entire cost, we should stress, was paid by TVA ratepayers whose electric bills increased about 9 percent as a result of these efforts; appendix B gives more detail on our cleanup efforts to date and their cost.

We think that additional cleanup of emissions can be accomplished at reasonable cost to our ratepayers. An appendix to this statement, appendix C, outlines the projected range of costs and the assumptions used to arrive at them. We estimate that TVA rates would have to be increased by an additional 4 to 6 percent by 1995 if we reduced our emissions by as much as 50 percent below present allowable levels.

While each utility system's unique characteristics make it difficult to generalize, TVA's recent experience is useful from several perspectives. For one thing, it illustrates the advantage of applying the most flexible methods to achieve emission reductions. This means that in addition to having the flexibility to select the lowest cost emission control methods at particular plants, we could also take into account methods for reducing coal-fired generation on our power system. Our energy conservation efforts are a good example.

Our experience also suggests that the cost of compliance by other electric systems with any additional emissions reductions required to control acid rain may be overestimated. In evaluating the estimates of the increased cost to consumers of acid rain controls, TVA's own estimates for its system are instructive. The TVA system is in the heart of the high sulfur coalfields and TVA emissions currently are close to the average of all utilities in the 31-State area being considered. Thus, estimates that TVA ratepayers would experience no more than a 6-percent increase for its fair share of a reduction in the 31-State area of 12 million tons should be a useful benchmark. TVA's costs are influenced by the reliance on existing non-SO_2 emitting generating capacity and our plans to complete construction of four additional nuclear reactors by the end of this decade.

We further believe that any costs necessary to clean up the air should be borne by those who are causing the problem. The principle that the polluter should pay for cleaning up is sound economics and is built into the basic environmental regulatory framework we have established in this country.

Regarding technology, TVA has done pioneering work in SO_2 emissions control technology since the late 1960's, and our major role in flue gas desulfurization development began in 1972 with the construction of three 10-megawatt pilot plants at our Shawnee Steam Plant in Paducah, Ky.

Today our efforts are also focused on demonstrating Atmospheric Fluidized Bed Combustion which we think holds the greatest promise for the future of high-sulfur coal. That is the TVA 20-MW pilot plant you saw, Senator, on your visit down there. Such a plant could achieve greater than 90 percent sulfur removal and would produce less oxides of nitrogen than a conventional plant.

In conclusion, Mr. Chairman and members of the committee, we recognize that you have been among the most responsible and far-sighted in dealing with the acid rain problem and we commend you for it. Any increase in costs arising from a control program will be painful, but these increased costs need to be put into perspective. Compared to the costs which ignoring the acid rain problem may impose, these costs are reasonable. The bill you reported in the last Congress still stands as the high-water mark in the overdue effort to control acid rain. We think the American people strongly support taking positive legislative steps to clean up our air and not run the risk of greater damage from acid rain.

The majority of the TVA Board supports legislation now to achieve a 10- to 12-million-ton reduction in SO_2 over the next decade in a cost-effective manner and without subsidies of any kind, but the chairman—that happens to be me—prefers to wait until EPA recommends a level of national SO_2 emissions with the understanding that TVA would meet its fair share of the reductions at that time.

Mr. Chairman, we would be pleased to address any questions you or other members of the committee might have.

Senator STAFFORD. Thank you very much, Mr. Chairman. We really appreciate your statement.

I would say for the record that this Senator enjoyed a chance to travel to some of your facilities late last fall and have a first eye view of what you are doing to reduce the reduction and how it could be done in different instances in different powerplants and the fluidized combustion experimental development. How is that coming? Is that still doing well?

Mr. DEAN. The financing is being put together, it is coming along real well. We have no reason to think there is going to be any impediments to the successful conclusion of that project. As you know, the TVA Board is extremely enthusiastic about the prospects. We think it offers tremendous hope to the producers of low-sulfur coal and to the utilities in general.

Senator STAFFORD. Thank you.

In the course of your analysis in preparing for this statement, have you analyzed the employment impacts of acid rain control and, if so, what those results of your analysis might be?

Mr. DEAN. I think I have been doing enough talking.

Dave, do you want to talk about the impacts?

Mr. DAVID FREEMAN. Senator, living in the heart of the coal country we are, of course, very mindful of, sympathetic to and aware of the terrible unemployment that exists today in the coalfields. That unemployment, of course, was not caused by acid rain or any acid rain legislation. It exists today, it is very real and in our view we need relief. We would hope that the Congress would use its influence with the administration to release some of the money that could be put to work in the reclamation of the coal lands that had been mined before the good law that this committee passed. The mechanism is there, the money seems to be clogged up in the machinery of the Government. Those funds could put some of the unemployed miners to work.

We would like to accelerate the research and development of the new technology which has been an objective ever since World War II. Unfortunately we have had a zigzag attitude of stop and go. We are now on the verge of completing the technology. We feel a few hundred million dollars should be invested in technologies like the fluidized bed which will take this high sulfur coal and make it as valuable as the low sulfur coal. The fighting between the various forms of coal could then merge in a stream of prosperity for all. This is technology that is more efficient than current technology and will burn all kinds of coal equally well.

We feel that the technology that takes high sulfur coal and makes it into methanol and puts it in the gas tank needs to be developed. This is another opportunity where the Congress and the Government can help to put coal miners back to work. The miners' future lies in the technology to utilize the coal. We believe that those efforts would be in order. We do not believe that the acid rain legislation need be held hostage for a problem that it did not create, especially since our evidence shows that the significant damage from acid rain is occurring in Appalachia.

The irony of this whole debate is that the evidence is mounting that it is the forests of Appalachia and the visibility in the Ohio Valley which is suffering the most from the emission of SO_2. While some of it does travel to New England, Mr. Chairman, most of it lands right in our own back yard and we are therefore mindful and desirous of this legislation and this cleanup effort so that we can benefit as well as the entire Nation.

Senator STAFFORD. Thank you very much, David.

Is there any further comment from the Board?

Mr. RICHARD FREEMAN. I think he covered it very well. The opportunity as far as using the reclamation money I think is something that could be done now, it could very much ameliorate the problem.

Mr. DEAN. We have had a situation, Senator, that is somewhat similar to part of the problem. We had to drastically cut back our construction of nuclear plants because we were building more than the power loads on our system would require. We have instituted a retraining program which is showing considerable promise. I am not going to go into all the details but we have some information that is useful and it will help people move into other kinds of work. It has been very successful.

Mr. **David Freeman**. If I can make just one more statement, the frustrating thing to us is that at best any variations in the acid rain legislation would have some impact on miners' jobs over a 10-year period. We see an emergency situation now with respect not only to the acid rain problem but to the unemployment in the coal fields and we would urge the Congress to act now along the lines that we suggested.

Senator **Stafford**. Thank you very much.

As you know, our first witness, in this series of hearings, was Mr. Ruckelshaus and I was disappointed with his message that seemed to be that acid rain control should await further research and I take it that you would agree with that recommendation. I would ask if any of you have had the opportunity to review Mr. Ruckelshaus' statement or his policy recommendation and if you have or not do you have any comments?

Mr. **Dean**. We have seen his statement, Senator. I don't have anything to say about it right now.

Mr. **Richard Freeman**. I guess I would say, since I feel as does my colleague Dave Freeman, that the fundamental difference is that we don't feel that it is wise to wait until the evidence is irrefutable because the damage that is occurring now is irreversible. By the time the evidence may be irrefutable, it is going to be too late in many areas, especially with the forest stand. This is of great concern to us.

Senator **Stafford**. Thank you. I think your statement pretty much speaks for itself on this subject in any event as I listened to it.

Did you want to comment?

Mr. **David Freeman**. Mr. Chairman, we were not part of the decisionmaking process in the administration that led to the position that they took so that we are not in a position really to comment on the ingredients of it. It does speak for itself. The evidence on the issue seems to me also to speak for itself. The body that this Congress authorized to look at difficult scientific issues, the Academy of Sciences, reached a judgment some time ago that there was sufficient evidence to act. This agency which has, as the chairman testified, deep responsibility for electric power as well as a concern about the forests, reached a judgment that the evidence was there over a year ago that we needed to act. And it was significant to me that a body of scientists assembled by the White House reached the same judgment.

I feel, as a person who has studied these matters for a decade, that there is a stronger body of scientific evidence on this issue than we have had on almost any environmental issue, certainly stronger than in 1970 when President Richard Nixon said it is now or never for cleaning up the environment. It is just difficult for me to understand a judgment that is at variance with a prevailing scientific opinion.

Senator **Stafford** Thank you very much.

One last question and I will yield to my colleagues.

It is my understanding that the Environmental Protection Agency has recently completed a study of the economic benefits for an acid rain control program in the Midwest, so my question is, Are any of you familiar with this study and if you are, would you have any comments with respect to it?

Mr. **Richard Freeman**. I have seen only press references to it.

Mr. **Dean**. I am not qualified to say, sir.

Mr. **David Freeman**. There is a study that I have seen references to that is commissioned by the EPA where the consultants have made a finding that the benefits from improved visibility alone from an acid rain cleanup bill such as this committee has passed would have benefits that were estimated in the range of $4 billion a year with the benefits, interestingly enough, being centered in the Ohio Valley because that is where the visibility problem is the greatest. This study, of course, simply reminds us that acid rain is one aspect of a witch's brew of pollutants that have been thrown high up into the air and have not been cleaned up. We still have another chapter in this long, hard struggle that this committee has pioneered for air quality.

We thought in the early seventies that tall stacks was a solution. We now realize that a sufficient amount of material is found in the form of particulate matter, sulphates and the precursors of acid rain to recognize that we have to finish the job. The benefits from this acid rain control legislation will certainly and obviously be greater than just the specific acid rain impacts. Not only the improved visibility but certainly there will be other benefits with respect to reduced sulphates and other forms of pollution. Therefore, of all the environmental issues that I have studied, I think the evidence on benefits with respect to cost are as compelling here as any I have ever seen and I feel that the case is there in spades right now.

Senator **Stafford**. Thank you very much.

I tell my colleagues that I had intended to limit myself to 10 minutes, I have gone over a minute or two but if it is agreeable on the first round since there are several of us here now if we can limit ourselves to 10 minutes, if that is agreeable.

Is there any dissent from that?

Hearing none, let's try to make it 10 minutes apiece.

Senator Randolph.

Senator **Randolph**. Yes, thank you very much, Mr. Chairman.

Chairman Dean, David Freeman, Dick Freeman, you came to your positions through this committee, is that right?

Mr. **David Freeman**. Yes, sir.

Mr. **Dean**. We have been here before.

Mr. **Richard Freeman**. In large part through your good graces.

Senator **Randolph**. I want to ask you, David, do you purchase West Virginia coal?

Mr. **David Freeman**. Yes.

Senator **Randolph**. How much? Or do you purchase coal generally and how much?

Mr. **Dean**. We buy a lot of coal but I don't know how much of it comes from West Virginia.

Mr. **David Freeman**. I am embarrassed to say I do not have that number in my head. I do recall, however, that when I came on the

TVA Board we were not purchasing any West Virginia coal. As TVA came into compliance with this committee's air quality law and needed to clean-up, the West Virginia coal became competitive on our system. We made a significant purchase of West Virginia coal and the volume in which that persists is something we will supply to you.

Senator **Randolph**. Are you not the largest single purchaser of coal in the country?

Mr. **David Freeman**. I believe that it is possible that the American Electric Power System surpasses us slightly but we are a close second. We were purchasing around 27 million tons a year, they may buy a million or two more. If we are not No. 1, we are a close second.

Senator **Randolph**. The coal that you purchase, and use, what does it do to the air in the Tennessee Valley Authority area?

Mr. **David Freeman**. We are proud of the fact, Senator Randolph, that as of December 1983 we have brought all 62 units of our 12 fossil plants in compliance with the air quality law. This was a very, very tough struggle over the last 6 years. We worked out an agreement with the EPA and the various citizen groups that had sued TVA. We have come into compliance so that I would say that the coal that we emit today while it has still a substantial quantity of SO_2, it is in compliance with the law.

Our position is that we know enough to warrant further reductions nationwide and we are willing to do that as part of a national effort. But as of the moment we feel that we are doing at least as much as the law requires and we are exercising some leadership in making available the facts about our cleanup effort and expressing our willingness to participate in a cost effective approach to the acid rain problem which in our judgment is just not taken care of by the existing law which deals with local air quality and local air sheds and really does not have a mechanism for dealing with the long-range transport where one emitter, polluter in one area actually affects the air in a distant area.

Senator **Randolph**. David, how many States comprise the Tennessee Valley Authority? Would you list them?

Mr. **David Freeman**. Yes, sir. Almost all of Tennessee, northern Alabama, and Mississippi, a corner of Georgia, western North Carolina, a tiny corner of Virginia, and southern Kentucky.

Senator **Randolph**. Would you say that the creation of the Tennessee Valley Authority was a necessary piece of legislation?

Mr. **David Freeman**. Yes, sir, I certainly would and I feel honored and humbled to be answering questions from the single Member of Congress who sits in the Congress who voted for that legislation at his political risk, as I understand it, because in those days the great fear was that this hydroelectric system was going to eliminate coal as a source of energy. I am proud to say as we sit here 50 some years later TVA is the major market for coal in our part of the country.

Senator **Randolph**. Mr. Chairman, it would be a good time, when he speaks so generously, for me to stop.

Senator **Stafford**. I thank you very much, Senator.

I say to my colleagues, I understand that Senator Baucus has an urgent downtown appointment and I would like to accommodate him at this point if that would be all right.

OPENING STATEMENT OF HON MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senator BAUCUS. I will take about 5 minutes here.

Senator MITCHELL. Keep a record of this, Mr. Chairman.

Senator STAFFORD. I will.

Senator BAUCUS. I would like to thank all of you for your statements for a lot of reasons, and one is that because of the acid rain problem we are facing in the country and because we, in the West, have a slightly different point of view obviously than some other sections of the country, I sent out a questionnaire survey to all States in the country asking Governors, public utility commissioners, and various air pollution control agencies in the State to respond to three specific questions and the questions were basically, first, in their judgment is there an acid rain problem in the country, a significant problem that must be addressed; the second question, what should be done about it, if anything; and third, who should pay for it?

I have received responses now from 30 different States—responses from Governors, public service commissions, State legislatures, et cetera—and I can tell you that the responses that I am receiving, and obviously this is not a great scientific survey but it is the best I can do in the circumstances, the responses that I am receiving are virtually on all fours with your testimony. That is, No. 1, there is a very signficant severe problem that must be addressed now rather than later and I particularly appreciated the comment of one of you that to wait until the evidence is irrefutable, it is going to be irreversible, that is the problem.

The first point, about the preponderance of doing something, I am finding the electric utilities who are individually responding to the survey are split and say, yes, there is a problem and something has to be done even though that is not the official position of the industry.

Second, from utilities and public service commissions that have written in, I am finding, incredibly so, that there is virtually no support for cost sharing; there is very strong support for the principle of let the leadership pay.

Finally, with respect to what types of controls—that is, what should be done about it—the responses I am getting, as I say, three different States have written in thus far. The responses are virtually no support for the mandatory scrubbers because they are expensive. Rather we should find the lowest cost solution and flexibility to various utilities so they can find the lowest cost for the solution.

As an example of one of the letters I received, I just happen to have here with me a letter from Ottertail Power Co. in Minnesota and I think basically standing for the principle that the polluter should take, just one sentence:

> Proposed taxes on non-nuclear electrical generation or taxes from initiatives which would be used to create a fund for partial financing of controls to be installed in the larger sources of pollution would be an especially unfair burden to impose on our customers who have already paid their share of the cost.

Also a letter from the West Virginia Air Pollution Control Commission which I think states the general problem quite well in one sentence.

> The acid rain question is an environmental, social, economic, and political question that cannot be solved by one State alone and must have action by the Congress and leadership from the U.S. EPA.

I just want to thank the Board. I think you have been very helpful and I think what you are saying and what the response of my very unscientific survey is saying is that we, the leadership, must move.

Thank you very much.

Senator **Stafford**. Thank you very much, Senator Baucus.

Senator **Baucus**. Thank you again, Mr. Chairman, for letting me proceed out of order.

Senator **Stafford**. Senator Durenberger.

Senator **Durenberger**. Yes. I will stick to 5 minutes, too, if that is appropriate. We have a long list of panelists. I am glad that I yielded to Max. I think you are finding out what all of us have been finding out, that this is the fairest way to go in this country. I think the record ought to show that in addition to Ottertail Power & Light and West Virginia Power & Light that on August 25 of last year Montana Power Co. came to Minnesota to testify in favor of a broad based emission tax[1] rather than an electricity tax or some of these other alternatives so you can take credit for having responsible utilities in your own State that are willing to stand up to whatever it is, this national utility constituency, and be positive about acid deposition.

My question, gentlemen, is probably a two or three part question but I will lump it all together. Part of it you heard before when I asked Governor Dukakis about the differences between the Mitchell-Stafford and the Waxman-Sikorski approach which is a State-by-State approach and I think even in your testimony you talk about:

> These SO_2 reductions should be allocated to the States proportionally to their total SO_2 emissions for the 1980 base year. States should have flexibility in allocating their required emissions reductions.

My question to the Governor was, do you trust the States? I mean is Ohio more trustworthy than all 50 States and their problems, is that a more trustworthy way for the Nation to solve the problem than going to EPA and trying to solve it on a national basis? That is one part.

The second part that I asked him was, is that faithful to least cost? If it is going to cost us a bundle of dough one way or another, directly or indirectly, to solve this problem, should we not try to get as close to the dollars back in emissions reduction for every dollar we spend and is this principle of letting the States decide 50 times or 48 times over is that faithful to the principle of least cost?

Then third, with your heavy emphasis in your statement on this it seems to me the problem with the bill that this Committee has already passed is that it is the electrical utility industry that is going to pay again. I mean they are all in place, they can't move, they are easy to get at and when you say to the 48 States, go and reduce, they are going to go at the biggest, easiest target and right now that looks like the electrical utility industry but they are only half of the problem. You have all of those other States and their resources out of their docks, you have the global and stationary problem with docks. Why not go after them?

---

[1] A response from Senator Baucus and Montana Power Co. to Senator Durenberger's statement may be found beginning on p. 274.

Mr. **Dean**. I think Richard up to this point being very quiet, we will let him talk. He is making some notes.

Mr. **Richard Freeman**. Well, there is obviously merit in the implications of your question and I suppose from our perspective in dealing with the States in our area once the allocation is made among the States, which is a national allocation, then we are prepared to trust the State to permit a least cost approach because it is obviously in the interest of the utility and their rate payers and also of the citizens of the State that there be a least cost approach.

As to the latter part of your question, I would refer to it as a real world issue, isn't it? I think our view is that in the world that we find ourselves in, it is probably unrealistic at this stage to expect once the allocation is made you should include all polluters. We are prepared as a utility in the real world to take the brunt because I think it is manageable and a manageable cost. In a perfect situation I just would be delighted if you would try to weigh this in Congress and try to find a way to have every polluter, not just the utility polluter but every polluter, to pay and if you come up with that solution I don't think you will have any problem from us.

Senator **Durenberger**. Is the problem political?

Mr. **Richard Freeman**. It is also administrative.

Mr. **Dean**. In our area we don't have a lot of big steel mills or anything like that. In other words, utilities are the primary coal burner down our way and it varies quite a bit.

Mr. **David Freeman**. I will just say, Senator, that there is a tie-in between the ability to pay and trusting the States. If the economic impact of not going least cost is going to be felt in that State you have a better basis for assuming that the State will go about it in a least cost method. Now one needs to have very strict administrative mechanisms to make sure the States meet their quota in the allocation process.

Senator **Durenberger**. I hear your testimony to be, and I put the two of them together, that you assume the only practical way to go is to load this bill on the electric industry of the United States and you think the industry can take it because you know State to State that is the easiest place to go with it to raise money.

Mr. **Richard Freeman**. I think I would rephrase at least to this extent. We are prepared to accept that burden. I think we would be delighted to share if that is administratively and politically possible. That would be delightful from my standpoint but we are prepared to accept the burden because we think that the problem is significant, it does require attention now.

Mr. **David Freeman**. I would just add this thought to carry on with the question Senator Mitchell raised earlier. We are firmly on the side of getting legislation passed now and we therefore are realistic enough to realize that the utilities must be a principal component of the control bill if we are to get the legislation out. We feel that the overriding issue is whether we get at the acid rain sources and we are on that side of the issue. We feel that these nice questions about how to finance it and others are very, very subsidiary and must be subsummed by those who are sincere in having reached the judgment that we need legislation now and we are.

Senator STAFFORD. Thank you, Senator Durenberger.

Senator Mitchell.

Senator MITCHELL. Thank you, Mr. Chairman.

I want to commend the gentleman for the statement that you make today, it is very forthright, very persuasive, it adds to my belief that the creation of the Tennessee Valley Authority was one of the historic achievements in this country's history and you have followed a long line of distinguished precedessors who contributed greatly to the economic well being of the region you serve and therefore the country as a whole and I say that as someone who comes from a State whose tax dollars are used to promote economic development in your area though we derive no direct and immediate benefit.

I would like to first address a question raised by Senator Durenberger to you and others. The question is asked in the form do you trust the States? Can you trust the States? The first answer is of course yes, we trust public officials to do their duty as the law requires. But secondly I think the implication is misleading because it creates the implication that if the States do not act under the legislation that I introduced, and Senator Stafford has comparable legislation, that nothing will happen but it should be clear for the record that under that legislation if a State does not, as required by law, submit a plan to achieve its mandated reductions or if that plan is disapproved by the EPA Administrator, a specific federally mandated strategy will go into effect under which the owner or operator of each fossil fuel burning electric generating facility in that State must comply with an emission limitation at all of its facilities in the region which is equivalent to an average of 1.2 pounds of sulfur dioxide a million Btu's among those facilities. So there is a very powerful backup incentive which does not require simply trusting the States and I think that is a very important fact which has been omitted in the discussion and which should be made because it creates a carrot and stick approach which I feel is by far the best one.

I do want to ask a question regarding your estimates of increase in your utility cost. First I note and commend you for a very aggressive program of sulfur dioxide emission. My first question to you is, are you aware of any other utility in the United States which has accomplished a comparable program of sulfur dioxide emission during that period of time?

Mr. DEAN. Actually the TVA wouldn't burn high sulfur coal and these reductions which have been put in effect in the last few years have brought us to an emission level which is quite comparable or we might say about average for the eastern part of the United States. There are some utilities that did various things back in the midseventies or maybe before that have brought their levels down pretty low, contracted for low sulfur coal, used scrubbers and things like that. We can, of course, supply you some details on that, I would rather not off the top of my head.

Mr. **Richard Freeman**. I think to put it in this context, fortunately or unfortunately we are about the biggest in everything. We are, as Senator Randolph recognized, one of the largest burners of coal and we are in the heart of the high sulfur coal area, so we were one of the largest polluters. We are now not one of the worst polluters as a result of spending, I am sure, much, much more than anyone has spent to clean up the air but we started from a point requiring a lot of action.

We have gone from 2.3 million tons of sulfur put out in the air to 1 million but we are still significant. I think it is with that caveat we say that we don't deserve a complete white hat. We wish to have a white hat in the sense that we feel that we want to bear a fair share, in answer to Senator Durenberger, of the need for additional cleanup.

Senator **Mitchell**. The thrust of my question was this. In the next few weeks we will be marking up a bill. One of the primary considerations which we must take into account is the effect of any legislation on people throughout the country and especially in the high emitting areas. The most common yardstick used for that effect is electric utility rates and what this bill will do to those rates. We have heard, we will continue to hear, very widely divergent expressions of opinion.

Since we are dealing with future economic events and since the human ability to predict future economic events is limited, no one can be certain. We have heard in this committee bandied about just in the last week a figure of 50 percent increase in electric utility rates if the bill that I introduced was enacted. Now since we can't tell for sure what will happen, one characteristic of human beings is to credit estimates given by people who have experienced a certain course of action to give it somewhat more credibility.

Now you have come in with an estimate that a 12-million-ton reduction will cause, in your case, a reduction of 4.5 to 6 percent and that reading from attachment 1 to your testimony. Further, although you did not state it during your testimony, I think it is significant that the document reads that a 10-million-ton reduction would produce an increase in rates of 2.5 to 4.2 percent and further that a reduction of 8 million tons nationally would produce an increase in rates in your case of zero to 2.6 percent. Those are significantly different and very much lower than estimates of some of the utilities who oppose this legislation and I am trying to get at the experience in your case. Now clearly no utility will be in a situation identical to yours. Since you are so large, there is one distinction right there.

Mr. **Dean**. Senator, in our testimony, we did mention the fact that everybody's situation is somewhat different. We do have more reactors coming on that have to be factored in. If we have low load growth, which is a possibility, and we bring on only the four nuclear reactors now under construction, those reactors will not only take care of our load growth but will also take some of our coal plants out of service. We also have a very aggressive conservation program, and when you achieve more conservation it is just that much less coal that we would be burning.

Mr. **David Freeman**. Let me respond to your question in this manner. First of all TVA is performing the very function which the Congress had in mind in enacting the legislation creating the TVA. We are providing the Congress with information that can be used as a benchmark for gaging the performance of the private utility industry. That was one of the fundamental purposes. We believe that our data can be used as a benchmark.

While we have reactors coming on, we also are above average in the Nation in the use of coal and we will still be a very large consumer of coal. We believe our conservation effort is something the committee should notice and perhaps bring in the legislation. The way to reduce the causes of acid rain and save consumers' money is to have every utility in this country have a conservation program similar to ours where we finance for the consumer conservation measures and they pay it back in the electric bill. We found that that program is very successful. We have reached 800,000 homes with that program and we have in that way built the equivalent of a large nuclear reactor and I will tell you it is not only one that works, it is the cheapest one in the country by far. So that the estimates of the cost of compliance that you will get, I can say without fear of contradiction, from an organization which is opposed to your legislation, will be based on a series of assumptions that are worst case. An estimate that does assume the worst combination of circumstances.

We believe that our estimates do serve as a benchmark although there will be some utility systems that would incur higher levels of cost and some lower. We also think it is important evidence to support a least cost approach. There is a lot of difference in the cost between a situation where a scrubber, for example, would be mandated on a plant that operates 5 or 10 percent of the time and in complying in a cost effective manner. Coal washing is a very cost effective measure, that can take a third of the sulfur out, and conservation will actually save the consumer cost.

Those factors would tend to temper some of the estimates plus the fact that if you assume these costs rather than assuming you are going to have to put scrubbers on plants where it is not cost effective, that will reduce the cost estimates.

Senator **Mitchell**. And that is, as you are aware, an important provision in the legislation which I have introduced in the modified version of which the committee approved in the last year.

Mr. **David Freeman**. That is correct.

Senator **Mitchell**. What you are suggesting is that we begin mandating national specific technologies. We inevitably cause a dramatic loss in flexibility and therefore a dramatic increase in cost.

Mr. **David Freeman**. There is an element of self-fulfilling prophecy there. The very high estimates that are coming to you can be legislated by legislation that requires wasteful approaches to implementation so that there is a connection between lower estimates and the least cost approach and if one separates the two then our estimates are not as usable a benchmark as they would otherwise be.

Mr. **Dean**. Most utilities operate across State lines as we do and we made several adjustments within our system. TVA took a systemwide approach when they started this program and that is what we mean by the least cost. We have scrubbers in some places and in some places we have precipitators and different approaches to this business of cutting emission.

Mr. **Richard Freeman**. Our engineers like to say, as the chairman heard, we have one of everything in terms of controlling acid or controlling SO_2.

Senator **Mitchell**. Well, I thank you very much. My time is up. I may have some other questions that I will submit in writing. We appreciate very much your testimony, it is extremely useful, particularly your use estimates on cost of compliance.

Senator **Stafford**. Thank you, Senator Mitchell.

For all members of the committee who were not able to be here this morning due to conflicts, I would reserve their right to submit questions in writing.

Mr. **Richard Freeman**. We will be delighted to answer them.

Senator **Stafford**. Let me add my thanks to all three of you for being here, for the opportunity to travel through TVA land with you last fall which I found a splendid education and I would recommend that all members of the committee do that, and for your excellent testimony this morning. Thank you.

Mr. **Dean**. Senator, we would be delighted to see any of the other committee members or staff people come down any time for a visit.

Senator **Stafford**. Thank you.

The Chair would now invite the panel to follow consisting of Mr. William T. McCormick, Jr., Dr. Alfred Munzer, Ms. Ruth Gonze, Dr. William B. Harrison, Mr. Carl E. Bagge, and Dr. Benjamin Dysart if they will come forward to the witness table;

Ladies and gentlemen, we welcome you here on behalf of the committee. It would be my intention to call upon our witnesses in the order in which we have you listed if that is agreeable. We are advised that you have each been identified and we are asking you to limit your oral testimony to 10 minutes and the Chair is going to informally keep time on you because we do want to stop before we run into the Senate session this afternoon. Your statements will be in the record where you have supplied them.

Having said that, we will start, Mr. McCormick, with you. Mr. McCormick is the president of the American Natural Resources Co. of Detroit, Mich., speaking on behalf of Alliance for Clean Energy, Rosslyn, Va.

Mr. McCormick.

STATEMENT OF WILLIAM T. McCORMICK, JR., PRESIDENT, AMERICAN NATURAL RESOURCES CO., DETROIT, MICH., SPEAKING ON BEHALF OF ALLIANCE FOR CLEAN ENERGY

Mr. **McCormick**. Thank you, Mr. Chairman.

The Alliance for Clean Energy, as I think some of the members know, is an alliance of low sulfur coal producers in the East and West. Together we have produced approximately 25 percent of all the coal produced in the United States and, in terms of low sulfur coal production, we produce approximately two-thirds. Our representatives produce in most of the major regions of the country and the majority of low sulfur production is sold in the East and West.

We in ACE recognize that the acid rain issue is a very controversial and a very difficult one and the reason we are here today is not to support any particular piece of legislation but because we recognize that the Congress, both in the Senate and the House, is moving on this issue and we want to make sure that our points of view as low sulfur producers are heard in that debate.

The essence of the ACE position is that, if Congress decides to enact acid rain legislation, it should be a cost effective one and one that permits utilities to freely make the best economic choice between switching to low sulfur coal or scrubbers.

I am pleased, Mr. Chairman, that the basic concept I have just enunciated has been in the committee's bill and so if there is legislation, the ACE group would support the basic concept that is in the committee bill. Our position in favor of freedom of choice and against national mandatory scrubber legislation is based on a few simple but, we believe, compelling arguments.

The first, Mr. Chairman, is one that I think very few people understand; it is that there are large amounts of low sulfur coal in the East as well as in the West. As you can see from exhibit 1 in my testimony, the recoverable estimates of low sulfur coal reserves are 7.5 billion tons in the East and 8 billion tons in the West. So, simply put, there is as much low sulfur coal in the eastern part of the United States as there is in the West. So the point of view that has been held by many that this scrubber and nonscrubber issue is one of East versus West is simply incorrect.

The second point I would like to make is that in almost all cases utilities can reduce sulfur emissions much less expensively by converting to low sulfur coal rather than investing in costly scrubbers. Included in my exhibits as attachment 2 and attachment 3 are summarized results of two studies by the Office of Technology Assessment and also by ICF, which has done studies for EPA, that estimate the cost of mandatory scrubbers to be anywhere between $30 and $40 billion of additional costs over the next 20 years to the American consumer. So it is our strong feeling that if the Congress does act on this issue it should not mandate scrubbers.

The third point I would like to make, and one that has been made by several members of the committee is that if mandatory scrubbing legislation is enacted, it could only realistically be financed through a national tax and I think as you and other members realize this is a question of equity among States. Many States have done a good job of cleaning up the environment and there is a question about whether they should pay for the difficulties of States that haven't done a good job.

The fourth point I would like to make is one that has been lost on many environmentalists and that is, if one is really interested in cleaning up the environment quickly, and I will refer here to exhibit 5, that switching to low sulfur coal can accomplish that a lot faster than mandatory scrubbing. We have utilities in our State that have made the decision in the last 3 months to switch to low sulfur coal within a period of less than 1 year. There is tremendous capacity of low sulfur coal production in the East and the West. We estimate existing capacity to be approximately 200 million tons with over half of that being in the East and we also estimate that a 7 million ton annual sulphur reduction would require only about 100 tons of additional low sulfur production capacity. So simply put, there is plenty of coal, there is plenty of capacity to meet whatever levels of sulfur reduction the Congress eventually decides it should have.

The fifth point I would like to make relates to the jobs issue. We have undertaken a number of extensive studies, one of which is attached in exhibit 6, which shows that the jobs issue is really an issue in two States, Ohio and Illinois. Even in the case of West Virginia and Kentucky there is almost as much low sulfur coal in those States as high sulfur coal and our estimates show that if utilities were given the freedom of choice to pick the least cost strategy that there would be increases in jobs in Kentucky and West Virginia, in the low sulfur regions, that would more than offset the losses in the high sulfur regions of those States.

We estimate that the number of direct jobs lost in those two States would have significant effects for approximately 12,000 direct jobs. I should point out, as I think one of the witnesses before indicated, that in the last year the coal industry has lost approximately 20 percent of its total jobs due to recession and this is approximately 50,000 jobs throughout the industry. I don't mean to make light of the jobs in Illinois and Ohio, but to put it in perspective, the order of magnitude of the jobs lost that would result from a shift to low sulfur coal would not be large—as a matter of fact, it would be smaller—compared to the losses that the coal industry has seen as a result of the recent economic recession. We feel that the jobs issue, if there is legislation in the Congress, should be addressed but that it can be addressed much more cost effectively by targeted assistance programs that will help the limited number of people affected to relocate and readjust and that the cost of this would be only 5 to 10 percent, at most, of the cost of mandatory scrubbing under such a bill as the Waxman-Sikorski bill.

The sixth point I would like to make is that mandatory scrubbing obviously would lock in existing technology with sludge problems and other difficulties and, therefore, we do not feel that this approach from a technological advancement standpoint at this point is justifiable.

The last point I would like to make on the legislation per se is that we are not in favor of the caps and offset provisions that are in the legislation. We feel those would adversely affect States that have done a good job and would result in some limitation of the growth possibilities in those States.

So, in summary, we believe that the basic freedom of choice alternative is one that, if Congress decides it should move, we feel is most appropriate. Again we are not supporting any particular legislation at this point but our membership feels very strongly that your committee should know our views on this very important issue.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you very much, Mr. McCormick. Now we will hear from Dr. Alfred Munzer, who is from Washington Adventist Hospital, speaking on behalf of the American Lung Association.

STATEMENT OF DR. ALFRED MUNZER, CHAIRMAN, GOVERNMENT RELATIONS COMMITTEE, AMERICAN LUNG ASSOCIATION

Dr. **Munzer**. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, I am Alfred Munzer. I am a physician specializing in diseases of the lung. As chairman of the Government Relations Committee of the American Lung Association I am delighted to speak on behalf of that association today.

The lung is a very special organ; it is the interface between man and the environment. It is its function to take in oxygen and to release carbon dioxide and as such it occupies a surface that approximates the size of a tennis court. In spite of being so delicate as to allow the free passage of gases and in spite of its enormous size it is constantly bombarded by dust, fumes, gases, viruses, and bacteria. And so it is entirely appropriate that the American Lung Association places the highest priority on reauthorization of the Clean Air Act.

Today I would like to briefly review the health effects of exposure to the sulfur oxide pollutant complex, one of the precursor pollutants of acid rain deposition. I have based my comments on a publication of the American Lung Association which reviews recent research findings on sulfur oxides. This report, "Sulfur Oxides and Public Health: Evidence of Greater Risks," was introduced into this committee's hearing record during previous testimony on S. 768, November 15, 1983.

The emissions of sulfur-bearing compounds from burning coal and oil need to be controlled more effectively. Despite Government efforts, nearly 30 million tons of sulfur oxides are emitted in the United States.

Sulfur dioxide is the main sulfur product of combustion. As the sulfur content in the fuel increases so does the level of sulfur oxides. This gas reacts in the atmosphere to produce compounds such as sulfuric acid and sulfate salts which exist as microscopic particles up to 50 times smaller than the diameter of human hair.

Sulfate compounds dominate the mass of fine particles in most areas of the United States. Ambient air concentrations of fine particles have, in fact, remained unchanged over the past several years and in many areas have actually increased.

To pinpoint and analyze the effects of pollutants, researchers conduct toxicological studies with experimental animals, clinical studies of humans exposed under controlled conditions, and epidemiological studies of large populations exposed under highly variable amounts of air pollution. Health studies have focused on the impact of sulfur pollutants on the clearance of foreign matter from the respiratory tract or the defense mechanism of the lung, the respiratory mechanics of the lung, the aggravation of respiratory and cardiovascular disease, and finally mortality from respiratory diseases.

Clinical studies with human subjects allow researchers to investigate the responses of both healthy and special at-risk individuals to different modes and durations of exposures. Such studies have shown that sulfur dioxide affects a variety of physiological functions. In healthy subjects at rest, respiratory and cardiovascular responses have been consistently observed at exposure levels of 5 parts per million. The findings of several investigators suggest potentiation of sulfur dioxide's airway effects with mouthbreathing and increased exercise levels, as we take in more air. Studies suggest bronchoconstriction in healthy adults orally breathing sulfur dioxide concentrations of 1.0 to 2.5 parts per million. Of greater concern is the impact of sulfur dioxide on hyperreactive individuals—those particularly sensitive to airway constriction. They are approximately 16 million Americans. Such individuals include asthmatics and persons with disorders such as hay fever and other allergies.

Researchers observed bronchoconstriction, sometimes with wheezing and shortness of breath, at concentrations less than 1.0 part per million.

Senator STAFFORD. Doctor, would you repeat the number of people you are referring to?

Dr. MUNZER. Sixteen million.

Senator STAFFORD. Sixty million?

Dr. MUNZER. Sixteen—one six.

Senator STAFFORD. Sixteen. Thank you.

Dr. MUNZER. In another study, however, no effects were noted at 0.25 part per million. Recently reported research shows that 0.5 part per million of sulfur dioxide potentiated the response of asthmatics to cold, dry air.

Inhalation of sulfuric acid mist increases respiratory rate and decreases airflow rates and breathing volume, according to some studies with healthy adults. Other studies have indicated that pulmonary function is almost totally unaffected by levels of 0.1 to 1 milligram per cubic meter of sulfuric acid for about 10 to 20 minutes. One researcher found that the bronchoconstrictor action of a drug called carbacol was increased by sulfuric acid administration. Another study found that mucociliary clearance, the mechanism that we have to keep our lungs free of other hazardous substances, is adversely affected by breathing sulfuric acid at concentrations of 1,000 micrograms per cubic millimeters. The decreased clearance persistent and chronic depression of clearance with repeated exposure to the same concentrations of sulfuric acid occur.

The evaluation of public health risks from air pollution is a seemingly straightforward matter—a series of dose-response relationships are applied to a set of pollution measurements of population exposure. These determinations, however, are subject to considerable disagreement within the scientific community. Still, while opinions differ on the magnitude of effects from exposure to air pollutants, the concensus is that increased air pollution and in particular increased sulfur dioxide emissions, will be associated with worsened general public health. Under severe pollution conditions, each incremental microgram per cubic millimeter can be expected to increase the death rate from 1 to 14 deaths per 100,000 population.

The efforts by Federal, State and local authorities to reduce pollution of the air by sulfur oxides have achieved mixed results. The observed effects on asthmatics of sulfur dioxide breathing 0.25 to 5.0 parts per million and of sulfuric acid at 100 micrograms per cubic meter should be taken into account in making decisions regarding control strategies for sulfur dioxide.

Both the elevated sulfate and sulfur dioxide concentrations combined with elevated ozone levels increase the health risks to those people with preexisting illnesses, the elderly, the very young, and those I have already mentioned who are allergic.

Sulfur dioxide reductions which could be achieved through acid rain control legislation will have a dual benefit to the American people providing environmental benefits as well as reducing a potential public health threat. Therefore, the American Lung Association supports programs to achieve significant reductions in emissions of sulfur oxides from major stationary sources.

Thank you.

Senator STAFFORD. Thank you very much, Doctor.

Next the committee will be pleased to hear from Ruth Gonze who is assistant legislative director of the American Public Power Association.

STATEMENT OF RUTH GONZE, ASSISTANT LEGISLATIVE DIRECTOR, AMERICAN PUBLIC POWER ASSOCIATION, ACCOMPANIED BY MICHAEL BERGMAN, APPA STAFF SCIENTIST

Ms. GONZE. Mr. Chairman, I am Ruth Gonze, assistant legislative director of APPA. With me today is Michael Bergman, APPA staff scientist.

APPA is a national trade association of about 1,750 publicly owned electric utilities throughout the country. About one out of every six consumers is served electricity by a nonprofit public power system.

The American Public Power Association supports national acid rain control legislation which meets reasonable standards of effectiveness, economy, and equity. As suppliers of electric power, about two-thirds of which is derived from fossil fuel, our members are willing to pay their share. Yet we also have a responsibility to millions of consumers to assure that costs are fairly apportioned and that an acid rain control program achieves environmental objectives with a minimum of economic disruption.

We know that this committee appreciates the potential threat that acid rain poses to sensitive ecosystems. While a scientific consensus seems to be emerging that acid rain has to be controlled, the effects of acid precipitation are highly controversial. What is known is that all fossil fuel emissions from both local and distant sources, stationary and mobile sources are involved. There is just as much controversy about what kinds of controls to adopt and how to pay for them. A national program will cost a lot of money.

APPA believes that a reasonable balance of the public interest in a clean environment while spending the fewest possible dollars to achieve it and in dividing the costs fairly can be achieved through legislation incorporating the following principles:

First, the program should be funded through a nationwide tax on sulfur dioxide and nitrogen oxide emissions from all major stationary sources and mobile sources for which an emissions tax is feasible;

Second, the funds raised should be applied to a least cost emission reduction program;

Third, the program should be divided into two phases with implementation of the second phase to be triggered by affirmative congressional action; and

Fourth, emission reduction goals should be set to account for future growth, which means, in part, stating the real reduction requirements at the outset and rejecting offset requirements for new emissions.

To take that in more detail, let me start with emissions taxes, the only scheme which assures that the polluter pays because polluters pay in exact proportion to their contribution to the problem. The tax should be nationwide because acid precipitation is a national problem and it needs a national solution.

We all know that a lot of the cleanup will be done in the Midwest, which, without a national financing scheme, would suffer economic disruption unacceptable to the Nation as a whole. Not only residential electric consumers are involved, not only direct electric consumers are involved, but energy-intensive industries located in the Midwest, including steel, aluminum, autos, and chemicals, are involved. The higher their rate increases are, the harder their recovery from recession will be and the more job losses they will suffer.

Look at what an emissions tax does.

It credits past cleanup. States like Michigan and Minnesota, which have made large emission cuts, pay less because they emit less.

It gives incentives for future cleanup. Sources reduce emissions without any further Federal mandate simply to avoid the tax.

It is regionally equitable. States with low emissions like many in the West pay only their fair share.

It is administratively workable. Administrative difficulties have been raised as an argument against emissions taxes. We think that is a red herring. For sources which do not continuously monitor emissions, calculations can be made based on fuel sulfur content fairly easily. In any case, taxes can be fixed for ranges of emissions levels, just as we do for personal income taxes, and that will give us defensible tax liabilities without undue administrative burdens.

Let me add here that we oppose funding mechanisms in some proposals that have been based on kilowatt-hour taxes or other irrelevant units of measurement. The problem is emissions, and the solution should be a tax on emissions.

Our second recommendation is that we use the money to fund cost effective emission reduction measures. The cost savings for a least cost approach have been conservatively estimated at 25 percent. Such measures specifically include fuel switching, fuels protreatment and scrubber systems. We know that fuel switching is politically controversial and relatively uneconomic. But even if fuel switching is legislatively limited, a least cost standard, is valid. Its cost effectiveness is lessened, but not lost.

Even assuming that large unemployment impacts from fuel switching would occur, which are not acceptable, such impacts should, for example, be examined carefully to minimize extra costs, by taking into consideration methods such as those suggested today by the Alliance for Clean Energy.

Another way in which least cost principles may have to be abridged is in directing controls to particular source areas in order to help a particular sensitive receptor area. We support such limitations on the application of least cost principles, if and when such determinations about source/receptor relationships can be made.

The third point is that an emissions reduction program should have two phases, given the scientific uncertainty surrounding both the problem and the solution, the large cost of any control program, and the likelihood that we will know more in the future than we know now. A phased program assures us that midcourse corrections can be made if we need them.

Fourth, emission reduction goals must adequately account for future growth. That means that offset requirements should be rejected by the Congress. Offsets understate the real reductions which are required. The new capacity has a double whammy. It first pays for control technologies to meet new source performance standards, and then it pays for offsets from existing sources for the emissions that remain. Those offsets will be costly and scarce. We urge that the total emission reduction required be incorporated upfront in the program's emissions reduction requirement.

Mr. Chairman, APPA is the only national electric utility organization to embrace a comprehensive program for dealing with acid rain. We hope the committee will review the policy report which is attached to our testimony in detail. We are willing to take responsibility for the costs and requirements to bring acid rain under control in direct proportion to our responsibility for the problem. We believe our proposals point the way to a meaningful consensus in dealing with one of the most difficult environmental issues of our time.

Thank you.

Senator STAFFORD. Thank you very much indeed for a very fine statement.

We will hear next from Dr. William B. Harrison, senior vice president of Southern Company Services, Birmingham, Ala., speaking on behalf of the Edison Electric Institute.

STATEMENT OF WILLIAM B. HARRISON, SENIOR VICE PRESIDENT, SOUTHERN COMPANY SERVICES INC., ON BEHALF OF THE EDISON ELECTRIC INSTITUTE

Mr. HARRISON. Thank you.

Mr. Chairman, I am very pleased to represent Edison Electric Institute which as you know is an association of investor-owned utilities. It is especially pleasing because I have had the opportunity to hear testimony of the TVA representatives. I want to bring to your attention that I represent a number of utilities who are opposed to legislation for acid rain control at this time and I would like to quickly summarize for you the reason for that opposition.

I have submitted a formal statement for the record and I will attempt to synthesize that quickly and add other comments derived from my observations at the hearing this morning.

First of all we oppose the legislation because the objective is not clear. It seems to me that as we talk about 8-million-ton reduction or 10-million-ton reduction of SO_2 emissions we need to relate that to some environmental objective that will be achieved after having implemented that reduction. It is not clear at all to me what that objective is.

We hear words this morning about emergencies that exist. If we look at the most credible data provided by the National Academy last summer on the trends in SO_2 or SO_4 deposition or acidic deposition in the Northeast, we cite, for example, the Hubbard Brook data which show that in the period 1965 through 1981, the sulfate deposition was steadily going down. The nitrate deposition was going up and this raises one question right up front. Why this preoccupation with SO_2 which is a precursor for sulfates when the nitrates are relatively being ignored? Also, you will find in that same data that the acidity levels being measured are also going down. Where is the evidence of an impending crisis in a sudden and drastic change of conditions that must elicit an emergency response and immediate legislation without a clear understanding of the facts?

It should be also stated that, as we look at the great uncertainty between causes and effects of acid rain, we should examine what might be achieved as a result of the implementation of a 10-million- or 8-million-ton reduction. We find that at best it can represent a change of pH of the order of 0.2 or 0.3 unit.

We heard earlier today the representative from the TVA saying that the pH measured in the TVA district ranges from 4.1 to 4.4 and so what we are talking about is an effective change of pH on the basis of the more stringent emission reduction plan which is still the same order of magnitude of the normal fluctuation of what we have today. So it is perfectly clear that the perception of the acid rain issue has a big gap between the cause and the effect that you are trying to achieve.

Now let us also ask the question of what will be the consequences if this legislation is enacted even though we are not quite sure what we will accomplish? I heard the TVA statements about cost of implementation in their system. Let me point out to you that Mr. Freeman's assumption that other utilities are not taking these estimates as seriously as they is simply not correct. In the Southern Electric System, we have taken S. 768 and examined our facilities plant by plant to see what would be the most cost-effective strategy for implementing the provisions of that bill, whether it is shifting from high sulfur to low sulfur coal or installation of scrubbers. I can assure you that it has been a reasoned and careful approach.

Also, I can assure you that we start from a level of greater compliance than TVA. You may recall the statement that TVA only achieved compliance with the existing environmental regulations as of last year. The Southern Electric System, which burns between 30 and 35 million tons of coal per year, was in compliance with these laws in the midseventies and it is a significant difference from point of departure that we have from the TVA system as we attempt to implement the provisions of S. 768.

Also, you heard the statements that TVA is bringing on a number of nuclear facilities now in construction during this timeframe which obviously shifts the burden from coal to uranium, another explanation for why TVA costs for compliance are lower than ours. For the Southern Electric System, the least cost option for compliance is going to amount to about $850 million per year for our customers and we have to ask you and ourselves what will be the benefit derived from this significant increase in cost. That amounts to an 11.3-percent increase on a 5-year levelized basis or a 13.6-percent increase for the first year cost. These estimates are expressed in 1982 dollars.

Yes, these are different numbers from what you heard from TVA, but it is irrational to say that the TVA numbers are a benchmark for the whole industry when each one of our companies has its own mix of coal versus nuclear or its own expectation for growth in the next decade or its own starting point for the baseline of 1980 emissions.

Well, the other thing I wish to add is that though I am speaking for others opposed to legislation at this time, this is not to say that there is no problem; it is to say that we don't know exactly what the problem is or how to fix it. I speak from what I have judged to be a responsible position in this context. The Electric Power Research Institute and others in the electric utility industry are committing and have committed more resources to an understanding of causes and effects of acid rain than any other party to this debate. It seems to me that an awful lot of emphasis is being made on public relations and misinformation to dramatize the urgency for some legislation when in fact a much better purpose for current efforts would be to fully understand what the problem is before we attempt to implement a national strategy to address it.

Now in the praise that you gave the TVA, and I certainly don't want to take anything from that, I would like to point out that others in the electric utility industry are supporting what you saw there, Senator Stafford. In our own company we have been principals in advancing the development of five different scrubber systems over the past 10 years. We have been the pioneers of solvent refining, which is a way to make a clean boiler fuel from coal prior to combustion. We currently manage the most advanced development project for removing fine dust from high-sulfur coal combustion emissions.

So there are other players in this besides TVA, and I hope you will take that into account as you evaluate their testimony which was supporting your bill and ours, which is opposing the bill, but for which we believe there are good and sufficient reasons. I hope that you will give the research effort now underway a chance to work. The Federal Interagency Task Force on Acid Precipitation is now beginning to gather some facts which will go far beyond the Electric Power Research Institute program. So all I am appealing for is time. I think it is in the public interest to be sure we know what we are doing before we commit to what is often called "the $100 billion experiment."

Thank you very much.

Senator STAFFORD. Thank you very much, sir.

Now we will be pleased to hear from the gentleman we know well and has been here many times, Mr. Carl Bagge, president of the National Coal Association.

STATEMENT OF CARL E. BAGGE, PRESIDENT, NATIONAL COAL ASSOCIATION

Mr. BAGGE. Thank you, Mr. Chairman.

The Nation's coal industry is united in its opposition to this legislation. We long have supported the Clean Air Act goals. We endorsed the original enactment of this bill. There is no question that the Clean Air Act has many strengths, yet there remains too many burdensome regulatory and administrative requirements that sap economic growth without adding to the public's health protection.

In our view, the requirements proposed in the bill S. 768, in the PSD and visibility sections, add even further to the complexity of the act, and we therefore cannot support them or the amendment.

We also strongly oppose this legislation because of its acid rain provision. It would heap heavy costs on millions of Americans without any assurance of achieving the intended environmental results. What's more, it is unnecessary due to the continuing reduction of sulfur dioxide emissions that are taking place under the existing Clean Air Act.

Let me turn to another consequence of the acid rain provision that should concern those who are deeply committed to preserving this Nation's successful air quality management philosophy of the past 13 years.

The acid rain provision is intended as a technical amendment to address a specific environmental concern. As these hearings point up, there is wide disagreement about the need for and the efficacy of acid rain controls but there is no doubt that this provision would alter fundamentally the tenets by which air quality in this country has been regulated and carried out successfully for more than a decade. Let me explain.

Congress wisely chose to set national ambient air quality standards to protect human health and welfare, a concept that the coal industry has long supported. Congress also gave the States a degree of flexibility in the regulation of existing sources. The States are charged with the responsibility of limiting emissions from existing plants because they best can decide how ambient air quality standards can be met without compromising local economic requirements and local priorities.

This reinforces the dual goals of the Clean Air Act: To protect human health and welfare while also promoting an expanding economy.

Congress went a step farther. After 1971, all new powerplants had to meet stringent uniform Federal limits for maximum control of emissions called "New Source Performance Standards." Under this framework, as older plants are retired, they are replaced by new, more efficient ones that meet stringent emission limits. Therefore, when new plants are built and older ones retired, the Nation's air gets progressively cleaner, and that's what has happened. It's another example of how Congress has sought consistently until now to promote air quality together with economic growth.

But the acid rain provision of S. 768 superimposes even tighter emission restrictions on this now workable framework. It would force a cut in total sulfur dioxide loadings even though the overwhelming majority of counties and States throughout the Nation are already meeting national ambient air quality standards to protect human health and welfare.

The prescribed reduction would be equivalent to imposing a Federal emission limit on all existing plants, thus removing any flexibility the States now have to meet ambient air quality standards. Meanwhile, the provision effectively transforms large sections of the Nation into "non-attainment." All future economic growth would have to be achieved by purchasing costly "emission offsets." The difficulty in adding new sources and the costs would be compounded, because the cheapest "offsets" would have already been removed.

These hidden consequences—an indirect federally mandated emission limit on all existing plants and the "non-attainment status" for large areas of the country—subvert the very intent, the very premise of the Clean Air Act.

My point is simply this. The acid rain provision is therefore, we believe, an "environmental neutron bomb." It leaves the Clean Air Act's structure in place, but it destroys the act's strength, the act's vitality by rendering its basic purpose irrelevant. It gives the impression of attacking acid rain but in reality the provision is a subtle way to alter fundamentally the act's purpose to promote human health and welfare without damaging further economic growth.

I submit that dealing with perceptions rather than realities is a malady that has plagued the acid rain debate from the very beginning. Here are just a few of the most glaring examples.

This legislation assumes that acid rain is formed by the long-distance transport of sulfur dioxide emissions from coal plants in the Midwest to the Northeast. The perception is that this so-called long-range transport theory has been proved and is universally accepted. The reality is acid rain's causes and effects are among the most complex phenomena to face a host of scientific disciplines in years. The long-distant transport theory is simply one of many currently under research. I remind you that not even the National Academy of Sciences has determined precisely how and to what extent pollutants from one region affect other regions of the Nation yet there is growing evidence that acid rain formation is influenced more by local, not distant, sources and involve a host of emissions both manmade and natural.

If acid rain turns out to be a local phenomenon, then the lowering of sulfur dioxide emissions in other regions will have little, if any, effect on the acidity of rainfall in the Northeast which this bill is intended to confront.

The perception is that acid rain is the cause of widespread ecological damage and may be linked to human health problems. The reality is that laboratory experiments assessing the effects of acid rain on crops and forests have produced ambiguous results at best and no direct cause and effect relationship has ever been established in the natural environment. There is no credible evidence that acid rain is involved in human health problems.

Acidified lakes are real, yet there is a perception that thousands upon thousands of lakes can no longer support fish and other aquatic life. The reality is that according to the U.S. Fish and Wildlife Service there are some 200 acidified lakes in the country, chiefly in the Adirondacks, all of them in the Northeast and situated at the higher elevations.

We know that many lakes have been acidified for thousands of years. This suggests strongly that acidification is an evolutionary process. It means that there is still time to complete the studies which this committee and this Congress adopted 3 years ago and for rational action without fear of an impending ecological apocalypse.

The perception is that acid rain is increasing. The reality is that no trends in acid rain acidity are evident based on existing information. Indeed, the latest study by the U.S. Geological Survey concludes that rainfall acidity in the Northeast is stable.

The perception is that acid rain is the dominant influence in the acidification of lakes. The reality is that the available evidence suggests that acidification of lakes is influenced more by the inability of the lake's surrounding soils to buffer naturally occurring acids in the soils and vegetation.

The perception is that the existing clean air laws are inadequate to lower sulfur dioxide emissions from coal plants and that this country, as the Canadians allege, is somehow "dragging its feet" in the pursuit of air quality goals. The reality is that sulfur dioxide emissions are falling steadily even as coal consumption continues to go up. According to EPA, from 1972 to 1982, America's sulfur dioxide emissions fell 22 percent from 30 million tons to 22 million tons. Meanwhile, utility consumption of coal went up from 349 million tons to 594 million tons, or more than 40 percent.

What's more, Americans are spending $14 billion each year to carry out the clean air laws. No other industrial society, including Canada, can match this kind of commitment.

Finally, this bill is grossly unfair to millions of Americans who ultimately would have to bear the brunt of higher energy costs. We can argue about the total figures but most reports that I have seen indicate capital and operational costs of more than $100 billion. Such prospective increases cannot be rationalized as "moderate," as we have heard all too often. For many Americans, especially the poor and the elderly, even the smallest rise in electric costs are still too much.

These additional billions in energy costs would hit consumers without even any assurance that the heavy costs would lead to the intended environmental results. It's a $100 billion crap shoot with the consumer's money with the odds heavily weighted against success.

The coal industry wants the mysteries of acid rain's causes and effects unravelled, we really do. That is why the private sector is spending hundreds of millions of dollars on acid rain research over the next several years. That's why the coal industry early on supported title 10 of the Energy Security Act, a provision sponsored by Senator Moynihan of this very committee. That's why we are supporting S. 454 sponsored by Senator Robert Byrd. That's why we support and applaud President Reagan who courageously, we believe, is proposing direct, effective action to mitigate damages to lakes from acidification. The President's plan maintains the integrity of the Clean Air Act and its purposes and air quality regulations while expanding considerably acid rain research by the Federal Government.

Why shouldn't sick lakes be healed at reasonable cost with proven methods? Why are we attacked when we suggest that and why is this administration attacked when it suggests that we heal the sick lakes by proven methods which the Scandinavians have done quite successfully with a minimal cost? Why should these crucial mitigation efforts continue to be reviled by the environmental community as "band-aid" solutions if we are truly interested in dealing with the realities and not the perceptions of acid rain?

The coal industry is deeply committed to finding the answers about acid rain's causes and effects that confound the best scientists in the world. Let's go ahead and repair the damage but let's not ask American consumers to spend additional billions of dollars more on a crap shoot before we know what we are doing. This is both unwise and imprudent public policy.

We hope, and I add we sincerely pray—and we pray about these issues, I do at least, at night—that this Congress rejects this costly course and urge this committee to reject this unwise and imprudent legislation.

Thank you.

Senator **Stafford**. Thank you, Mr. Bagge.

The committee will next be pleased to hear Dr. Benjamin Dysart, the president of the National Wildlife Federation.

STATEMENT OF BENJAMIN DYSART, PRESIDENT, NATIONAL WILDLIFE FEDERATION, ACCOMPANIED BY KEN KAMLET, DIRECTOR, POLLUTION AND TOXIC SUBSTANCES DIVISION, NATIONAL WILDLIFE FEDERATION AND RICHARD AYRES, CHAIRMAN, NATIONAL CLEAN AIR COALITION

Mr. **Dysart**. Thank you, Mr. Chairman.

Senator **Mitchell**. Mr. Chairman, may I say something to my colleague?

Senator **Stafford**. Yes.

Senator **Mitchell**. Mr. Bagge, those of us who support the legislation also pray at night so perhaps we can hope that the Lord will be neutral on this issue.

Mr. **Bagge**. I am not counting on any neutrality.

Senator **Stafford**. Mr. Dysart.

Mr. **Dysart**. Mr. Chairman, Senator Randolph, Senator Mitchell, Senator Durenberger, my name is Ben Dysart. I am president and chairman of the Board of the National Wildlife Federation and appear before you this morning in that capacity. I am accompanied by Mr. Ken Kamlet who is the director of our Pollution and Toxic Substances Division and also Mr. Dick Ayres, chairman of the National Clean Air Coalition of which NWF is pleased to be a member.

I have submitted an extensive set of testimony for the record and would like to summarize a few of our principal thoughts in just a few minutes, sir.

I am familiar with the water quality, water resources, and environmental management areas as I am a professor of Environmental and Water Resources Engineering at Clemson University. I have been active in doing contract research and consulting work for a variety of Federal agencies and private sector interests.

I would like to emphasize two things. First, that we strongly support aggressive controls on sulfur dioxide emissions, and second, why we believe the administration's recently announced "more-research no-action" posture is both inappropriate and lacking scientific or any other justification.

Clearly, acid rain is a major environmental problem. Yes, it's a serious problem now and getting more serious. Sure, we need to know more about the whys, whats, wheres, whos and hows. I think we will always need to know more but in my opinion we already know what we need to know—certainly enough to know whether to act or not.

Obviously, the acid rain problem requires some very difficult political and public policy calls but the issue is not nearly as divisive as some would contend and I believe there is broad and growing support for confronting and solving the acid rain problem.

Perhaps most importantly, the American public wants, expects and, we think, deserves leadership from its elected representatives in the executive and legislative branches of our Government. The public expects a lot more than to have their Government representatives battling one another as opposed to battling the underlying problem.

Sometimes it seems that a preferred alternative to some is to consider all the interests to be like tomcats, tie all their tails together and throw them over a clothesline to let them all work it out. I think we can do better.

Mr. Chairman, I think this committee is showing the sort of leadership your constitutents, our members, and most of the American public wants on this issue and we hope that you will prevail.

On acid rain, as is true for many of our environmental problems, the American people seem to be out in front of many of their leaders in recognizing the severity of the problem and also in demanding effective responsive action. They recognize, even if the Dave Stockmans of the world don't seem to, that an acid rain control program is something like an insurance policy on an important part of the future of this country—the quality of our lives—the value of which cannot be measured by short-term and narrow-minded fudged-up or fudged-down cost-benefit calculations. Most of us take out life insurance which we continue to pay for year after year though we probably will not be around to reap its benefits. I think it makes eminently good sense to start paying now to forestall potentially catastrophic acid rain impacts.

Let me comment briefly on the acid rain control bills currently being considered by your committee. NWF supports the basic approach to acid rain controls of the committee's bill, S. 768. However, we urge the committee to adopt the 12-million-ton reduction target of the Stafford-Hart bill and also the 10-year time limit of the Mitchell bill.

We also support the inclusion in the committee bill of interim milestones to insure that the mandated reductions are not all telescoped into the final few years of the time interval. We need some early and we need some meaningful reductions.

While we support the concept of the lowest cost acid rain control program that will achieve the necessary reductions in SO_2, we are certainly mindful and very appreciative of the fact that some hopefully modest departures from least-cost controls may be necessary to avoid undue burdens on segments of the coal and utility industries.

We applaud the flexibility inherent in the committee bills in allowing and encouraging States to allocate emission reduction obligations among their generators in the most sensitive and cost-effective fashion. From an engineer's standpoint, that makes good sense.

The President, it seems, remains unconvinced. In his State of the Union address late last month he declined to put his administration in support of acid rain controls. Instead he called for an increased budget for acid rain R&D. Amplifying the administration's position, Administrator Bill Ruckelshaus in testimony last week emphasized the administration's view that more scientific information is needed before launching this country on an acid rain control program.

Yes, we do need to fill in some holes in our knowledge and we do need to fine tune what we know, there is no question about that. But we think the big pieces of the puzzle and also most of the little pieces are in place and the picture is there for anyone who wants to see it. There will always be uncertainty present. That's simply a fact of life here in the real world.

As most of you know, I am sure, questions have always existed on environmental protection issues, including those that depend on mathematical models, questions on their capabilities, limitations, components, fate and effects, source-receptor relationships, input data, and so forth.

Uncertainty in environmental matters is nothing new, it goes all the way back to the Broad Street pump, mysterious night vapors, sickness, and even extends to modern times involving dissolved oxygen in flowing streams, heated discharges, eutrophication in reservoirs, radiation downwind from nuclear containments, generation and transport of nonpoint source pollutant and also migration of toxics in ground water.

In most all of these instances, models and data were—and are—imperfect, the environmental and health consequences were—and are—great, and the economic cost and—more important—the incidence thereof were—and are—substantial concerns. But seldom, if ever, has it been impossible for perceptive scientists and engineers to come forward and help illuminate the difficult environmental questions, particularly when such action is supported by the public.

In my opinion, the arguments for no action based on uncertainty—and the need to know even more—are really not very persuasive. The acid rain problem as it stands today is not too different from its predecessors that I have just mentioned in the list of environmental problems that our Nation and this committee must face in modern times.

We are now at National Wildlife Federation just completing a brand new survey of 1,027 U.S. acid deposition researchers. The respondents to date have indicated their overwhelming support, based on the record, based on the evidence, for an aggressive acid rain control program. Only 14 percent of our respondents believed that more research or monitoring was needed before further controls should be undertaken. Four out of five of those scientists responding considered the risk sufficiently great as to necessitate immediate and decisive steps to curtail the emissions that cause acid rain. This seems to afford little support for the logic of delay embraced by the administration.

We were greatly heartened and encouraged last May when as witnessed that evening on network news by millions of Americans the President directed newly sworn in EPA Administrator Bill Ruckelshaus to confront the acid rain problem head-on. The fact that such an approach has been seemingly impossible to sell in some quarters downtown has been a source of disappointment to our membership and also to other proponents of natural resources conservation and wise use across the Nation.

We hope the administration will soon catch up with the public and see the light on acid rain. The National Wildlife Federation believes that this committee should not slow its pace and wait for the administration to match your bold strides.

I thank you, Mr. Chairman. We appreciate the opportunity to share our views with you.

Senator STAFFORD. Thank you very much, Doctor.

We understand that Senator Mitchell has an engagement on the floor and I will stick to the 10-minute rule.

I will recognize Senator Mitchell first for any questions and then the dean emeritus of this committee, Senator Randolph.

Senator MITCHELL. Thank you, Mr. Chairman. I am grateful to you and Senator Randolph. I do have to participate in a debate now going on on the floor on capital punishment.

I have a large number of questions which I will ask up to the time limit and then will submit the balance, if any, in writing.

Both Mr. Bagge and Mr. Harrison, were you present this morning when Governor Dukakis testified?

Mr. BAGGE. Yes.

Mr. HARRISON. Yes, sir.

Senator MITCHELL. My question to you is, do you know that he has proposed legislation that attempts to accommodate the interests of those who oppose acid rain legislation and I would like to ask you both if you could tell me, please, do you support that legislation?

Mr. BAGGE. No.

Senator MITCHELL. Mr. Harrison.

Mr. HARRISON. No, Senator.

Senator MITCHELL. Mr. Harrison, in your remarks you criticized this legislation, I think your words were, why this preoccupation with SO_2 when nitrates are being ignored? Would you support the legislation I have introduced if I added to it a provision mandating reduction of nitrates?

Mr. HARRISON. No, I would not, but may I explain why?

Mr. MITCHELL. No, I just would like to get that.

I want to ask Mr. Bagge the same question.

Mr. Bagge, would you support such legislation?

Mr. BAGGE. No.

Senator MITCHELL. Both of you state in your prepared text that sulfur dioxide emissions are expected to decline in the future. I have before me the document prepared by the EPA for Mr. Ruckelshaus and he testified that there is not expected to be any reduction over the next 20 years and he had no estimate beyond that. Would you both please submit for the record of this hearing the evidence upon which you base your estimate of continuing decline?

Mr. BAGGE. I base mine on EPA's own figures.

Mr. HARRISON. And so do I. Let me elaborate on that just a moment. As the provisions of the Clean Air Act as now implemented are effected with retirements and conversions from coal to nuclear in the future, then clearly the emissions from coal-burning facilities will be reduced. As you have said in alluding to the EPA information, the drastic reductions take place after the year 2000, somewhere in the year 2005 to 2010 timeframe. That assumes that retirements will take place as they are currently scheduled and that is only about 10 years after the implementation of the bills that are being considered.

Mr. BAGGE. I would like to say, Senator, I don't have to wait for the year 2000. We have evidence that shows although when coal was discovered in 1973 during the oil embargo and the utilities turned to coal and made oil to coal substitutions, we increased coal use in that decade to 40 percent and emissions declined 22 percent. That is not my organization's statistics, that is from EPA.

Senator MITCHELL. Well, on that point, Mr. Bagge, your written statement says the decline from 1972 to 1983 was from 30.4 million tons to 22.4 million tons. I have before me the EPA document to which I refer and it specifically concludes that the reduction was from 27.3 to 23.7, a reduction but significantly less than that alleged in your testimony. Perhaps you could provide us with the evidence in support of your statement in that regard.

Mr. BAGGE. I sure will.

Senator MITCHELL. Mr. Harrison, you pointed out that we are only talking about a reduction of pH of 0.3 percent and you asked why spend all this money to get a reduction of 0.3 percent. You are aware, are you not, that the effect of acidification is logarithmic in nature and that a 0.3-percent decline in pH would practically be a doubling of the acid content of a particular receiving body, is that correct?

Mr. HARRISON. I am fully aware of that, Senator Mitchell, but let me remind you that pH has that much variation from year to year just in terms of historic and national trends. As we look elsewhere in the world for what normal pH's may be, the range could go all the way from 4 to about 6.5. So what I am saying is if indeed you were fortunate enough to achieve a 0.3 change in pH by the legislative initiatives that are being proposed, it is still a very small thing compared to a wide range of the normally expected pH.

Senator MITCHELL. In your written statement, Mr. Harrison, you state, and you didn't say this orally, that what you see, and I am quoting it now:

> Is a frenzy of environmental activism, political rhetoric and media sensationalism based on an overly simplistic and superficial view of causes and effects of acid rain.

Mr. HARRISON. I believe that.

Mr. BAGGE. I believe that, too.

Senator MITCHELL. Let me ask you, Mr. Harrison, whether Mr. Bagge's statement describing acid rain as a neutron bomb could qualify as rhetoric?

Mr. BAGGE. I don't say that.

Senator MITCHELL. So you say the opposition is rhetoric and you are not.

Mr. BAGGE. Yes.

Senator MITCHELL. And that is the difference.

Mr. HARRISON. Yes, it is rhetoric and so perhaps is the quotation you made from my text.

Senator MITCHELL. Well, thank you, gentlemen.

I would like to read a statement issued by the National Academy of Sciences in September 1981. The quote is:

> Of the options presently available only the control of emissions of sulfur and nitrogen oxides can significantly reduce the rate of deterioration of sensitive freshwater ecosystems. It is desirable to have precipitation with pH values no lower than 4.6 to 4.7 throughout such areas, the value at which rates of degradation are detectable by current survey methods, as mentioned above. In the most seriously affected areas (average precipitation pH of 4.1 to 4.2), this would mean a reduction of 50 percent in deposited hydrogen ions.

Do you, Mr. Harrison, regard that statement by the National Academy of Sciences as a frenzy of environmental activism or political rhetoric or media sensationalism?

Mr. HARRISON. I do not so regard the statement of the National Academy of Sciences but I so characterize many of the things that have arisen allegedly based on that same statement. Let me remind you, sir, that the statement was made 3 years ago and if we are using it as a basis for our present position on this matter, we are ignoring the body of information that has been developed since that time which in my own opinion and those of many others with whom I have conferred is sufficient to completely change that perspective.

Senator MITCHELL. Well, that is subjective judgment, of course, and you are aware there are a very large number of people who would reach precisely the opposite.

Mr. HARRISON. Well, of course I'm aware.

Senator MITCHELL. The body of evidence substantially supports the case and strengthens the argument of the National Academy of Sciences.

Mr. HARRISON. I do not agree, sir, and I hope you will give me the opportunity to explain why.

Senator MITCHELL. Yes, I only have 10 minutes so I would ask you to submit that in writing.

Mr. HARRISON. In effect I have done that in the prepared testimony.

Senator MITCHELL. Yes, you have.

Mr. HARRISON. With the bibliography of references from very reputable sources.

Senator MITCHELL. I have read your statement very carefully.

You have heard the testimony of the TVA this morning. In support of their estimate of future costs and compliance with the legislation they submitted a detailed statement of the economic assumptions upon which they base their estimate. You have made contrary estimates, 11.6 percent or 13 percent, but I have looked through your statement and do not find any comparable substantiating evidence. Would you supply that to the committee, please?

Mr. HARRISON. I would be delighted to, sir. I am quite sure you will be persuaded that it is as credible as anything else you have seen. (See p. 405.)

Senator MITCHELL. Well, that remains to be seen, Mr. Harrison.

As I said, I have a very substantial number of questions for Mr. Harrison and Mr. Bagge but my two senior colleagues have been very gracious in permitting me to go ahead because I do have to go to the floor. I want to thank all of you for being here today and for your statements. I will submit those further questions in writing and look forward to your responses. Let us hope that both sides can tone down the rhetoric and stick to the facts.

I just want to say, Mr. Harrison, you are quite right about a lot being spent in support of the legislation, the only thing you omitted was at least as much was being spent in opposition to this legislation.

Mr. HARRISON. I concur.

Senator MITCHELL. Thank you.

Thank you both, Senator Stafford and Senator Randolph.

Senator STAFFORD. Thank you, Senator Mitchell.

Senator Randolph.

Senator RANDOLPH. Mr. Chairman.

Carl Bagge has referred to crap shooting.

Mr. BAGGE. $100 billion crap shooting.

Senator RANDOLPH. I remember in 1933 when I joined as a cosponsor of the first bill ever presented to the Congress for a national lottery. That was a bold step on my part if you know the background of the country from which I come.

I used to bet 10 cents on each game of checkers that I played against those who wanted to sit across from me. For the record, it is important that I note that in 1923 I won the checker championship—that is amateur—of a 10-mile district in Harrison County in which the community in which I was born is located.

Now I don't understand, Carl—May I call you by your first name?

Mr. BAGGE. I would be honored, sir.

Senator RANDOLPH. I can't understand your omitting any endorsement of S. 766.

Mr. BAGGE. Well, that is because we are working very hard to endorse your colleague's bill but we are also working on yours.

Senator RANDOLPH. Well, you didn't say so.

Mr. BAGGE. Well, I say so now. I want to amend my statement on page 9 and say we are supporting both Robert Byrd's bill and the distinguished Senator Jennings Randolph's bill as sponsors.

Senator RANDOLPH. I am a member of this committee, incidentally, the committee responsible for this legislation.

Mr. BAGGE. And a member of this committee.

Senator RANDOLPH. Yes, one who helped to bring into being the Clean Air Act.

Just for the record, my bill is to provide for an accelerated study of the causes and effects of acidic deposition during a 5-year period. Do you endorse that?

Mr. **Bagge**. Yes, indeed, enthusiastically.

Senator **Randolph**. To provide for the limitation of increases in sulfur dioxide emissions during that period. Do you endorse that?

Mr. **Bagge**. Yes, sir. Yes, sir, enthusiastically.

Senator **Randolph**. And to provide for grants for mitigation of sites where there are harmful effects on ecosystems resulting from high acidity. Do you endorse that?

Mr. **Bagge**. Yes, sir, enthusiastically.

Senator **Randolph**. I wish you had done that in your statement.

Mr. **Bagge**. I can get off base, too. You have to give me one slip.

Senator **Randolph**. It is a little difficult to have it after the fact and I hope that these omissions that you have indulged in this morning will not be continued at least when I am present.

Mr. **Bagge**. I think we are going to correct it when you are not present also Senator.

Senator **Randolph**. Mr. Chairman, I have been very conscientious in attending these hearings, just as you have been. I shall continue to work with you for action—whatever that action may be—within this committee. I commend you for the depth in which we have attempted to bring testimony from witnesses to discuss the matter of acid rain, and in saying that I used the words to the Governor from Massachusetts today "in haste." Now I repeat that, in haste. I do not mean that that is a year from now or 2 years from now but I do again express thanks to you and to all members of your committee.

You know, this is the committee which brought virtually all of the national environmental legislation into being. Is that right?

Senator **Stafford**. That is right.

Senator **Randolph**. Yes. So we must realize that throughout the years we have been mindful of our obligation and of our commitment. There is no desire on my part to delay, only the deeply routed concern that I have on the procedures, the actual programs that will be laid down. I put my neck on the guillotine when I was a sponsor of the creation of the Tennessee Valley Authority in 1933.

You see, Carl?

Mr. **Bagge**. Yes, sir.

Senator **Randolph**. I had the operators and the miners who marched on me from many States saying that hydroelectric power would diminish the sale of coal and mining employment. I take no credit for standing in front or on the sidelines as it were, but I have been in the midst of the battle and I am very careful as I study each and every provision of whatever the bill is before us. I hope you will not forget S. 766 when you appear again.

Mr. **Bagge**. It has been etched indelibly in my mind.

Senator **Randolph**. Thank you.

Senator **Stafford**. Thank you very much, Senator Randolph.

In view of some of the responses, Mr. Bagge and Mr. Harrison, might I ask you do you both oppose or support the present Clean Air Act as it is now on the books?

Mr. **Harrison**. I am sure that we support it. We do recommend that there are ways to improve it, to make it more cost effective, but you will find our industry in general and our company in particular is in compliance and support it.

Senator **Stafford**. Thank you.

Mr. Bagge.

Mr. **Bagge**. I think the same is true for us. We have problems with PSD, with visability, with a lot of amorphous concepts but we still support it. People forget that the coal industry supported the enactment way back in 1970 of the Clean Air Act and we have never been given credit for that but the answer in sum is, yes, but we have a lot of problems in trying to get permits in the real world and trying to deal with a lot of the bureaucracy here that frustrates us.

Senator **Stafford**. All right. Thank you both.

Dr. Harrison, we heard testimony Tuesday from several Governors and, incidentally, as was mentioned earlier this morning, we regretted that none of the Governors from the States which are principally affected by the proposed items in the legislation were able to accept our invitation so we didn't have a spokesman for their viewpoint in front of us. We did hear from several Governors and we heard from the northeastern and from the western Governors, from Montana and Utah, who have paid the price of clean air by dual source of commission. I am therefore constrained to ask of your Midwestern members could you tell us how many have installed scrubbers up to the present time?

Mr. **Harrison**. You are referring to the EEI members?

Senator **Stafford**. Yes.

Mr. **Harrison**. I am sorry, sir. I don't know that information offhand but I will be glad to respond.

Senator **Stafford**. If you would, we would appreciate it.

Mr. **Harrison**. Yes. (See p. 415.)

Senator **Stafford**. If you could also at the same time tell us what, if any, fuel switching might have occurred among your members.

Mr. **Harrison**. That might have occurred already?

Senator **Stafford**. Sir?

Mr. **Harrison**. Fuel switching that would have occurred already in the past?

Senator **Stafford**. Yes, that has occurred so that we might have that information in front of us.

Mr. **Harrison**. Certainly.

Senator **Stafford**. Mr. McCormick, in your statement this morning you indicated that you represent a number of companies that have holdings in Western low sulfur coal and you also have holdings in low sulfur coal in the East. Understanding that the working paper in front of this committee does not mandate any method of achieving lower reduction so that we are not attempting by this question to indicate a departure from flexibility, my question is should hypothetically fuel switching occur to reduce emissions by 6 or 7 million tons over a period of years? Is the industry that you represent capable of supplying coal if that were the option that the generating industry wanted to follow?

Mr. **McCormick**. Yes, Mr. Chairman. In exhibit 1B of my testimony I show some figures which suggest that probably 200 million tons of Eastern and Western low sulfur capacity is available today and, in the East alone, we estimate approximately 100 million tons capacity primarily in the States of West Virginia, Virginia, and

Kentucky. So there are very substantial quantities of low sulfur coal in the East as well as the West and the capacity exists to meet any reasonable sulfur reduction standards.

Senator **Stafford**. Thank you very much.

I am going to thank all of the members of the panel and I think that our guests as well as this panel and the others will be aware that this committee does not like to load these hearings up on any one point of view, we try to make a genuine effort to understand all the views.

Did you want to say anything further?

Mr. **Harrison**. Could I make one brief point in connection with the last subject, the low sulfur coal?

Senator **Stafford**. Sure.

Mr. **Harrison**. I hope that you and others of the committee are aware that even what sounded like a very simple strategy, switching from high sulfur coal to low sulfur coal, is not as simple as it may sound because many of our plants cannot do that. Many plants are designed for a specific kind of coal, and also you must recognize there is an incremental price increase, too, which must be taken into account.

One of the reasons that I mentioned cost earlier is that we have talked a lot about displaced miners in the context of this debate but not about unemployment in a broad way. There are many industries in our country that operate with a very small margin and this increase in nonproductive cost of electricity can make the difference in their survival in the international market as well as the domestic market.

Senator **Stafford**. Well, I want you to know and everybody here that the chairman of this committee is well aware that coal switching as contemplated is a very complicated issue.

Mr. **Harrison**. Thank you.

Senator **Stafford**. You need only ask the gentleman on my left to realize how complicated it is.

Thank you once again, all of you, for being here.

The committee stands adjourned.

[Whereupon, at 12:40 p.m., the committee recessed to reconvene at the call of the Chair.]

[Statements and other material submitted for the record follow:]

Statement of Hon. Max Baucus, U.S. Senator From the State of Montana

Mr. Chairman, we are nearing the end of our hearings on acid rain. We have heard testimony on all sides. The hearings have been very informative and will be extremely useful as this Committee develops legislation to address the acid rain problem.

Two years ago, we developed our acid rain bill. But the climate is very different today than it was then. The evidence of damage from acid rain seems much stronger. At the same time, though, the divisions between who wins and who loses have become much more finely drawn.

Two years ago, the acid rain problem was viewed totally as a Midwestern-Northeastern problem. It appeared the Midwest was causing a problem in the Northeast and it was in the best interest of the rest of the country to see that this problem was addressed.

The situation has changed. Although this Committee has remained firm in adhering to the longstanding principle that the polluter pays and that a least cost approach to the problem is the only equitable one, there are those who disagree.

Representing Montana, I was well aware of the commitment that has been made in my state to address the objectives of the Clean Air Act. I have stated on many occasions that meeting these objectives has not been without cost. I am firmly on record as being opposed to any acid rain solution which violates either of these principles. As the debate changed, I became increasingly concerned that the nation was going to be asked to address a problem that they had very little understanding of. In response to this concern, I have developed a survey which sets forth three questions.

Is there a problem?

What should be done?

Who should pay?

I wanted to know what people all around this country were saying about acid rain. To date, I have received responses from state legislatures, governors, air pollution control agencies, public utilities commissions, researchers, and the utility industry representing over 30 states throughout the country. I have developed a data base which includes all regions of the country. I believe I am safe in saying that the preponderance of these responses support addressing the problem. Even the electrical utility industry, which maintains an official position of not addressing the problem, is split on the issue. I was surprised to learn how many of them supported doing something. The one overwhelming finding of my survey was that there is incredibly little support for cost sharing. Utilities, state government, and public utility commissions from throughout the country overwhelmingly do not support national cost sharing programs.

Similarly, there is virtually no support for mandatory scrubbers. Responses as to the type of controls point out:

(1) the need for a least cost solution;

(2) a need for additional research; and

(3) the fact that we just can not afford mandatory scrubbers.

For my colleagues on the Committee I would like to quote from portions of letters that I have received from your state.

Senator Durenberger, The Otter Tail Power Company in Fergus Falls, Minnesota states, "Proposed taxes on non-nuclear electrical generation, or taxes from emissions, which would be used to create a fund for partial financing of controls to be installed on the larger sources of pollution, would be an especially unfair burden to impose on our customers who have already paid their share of cost."

Senator Randolph, I have not received a response from Governor Rockefeller at this time, but the West Virginia Air Pollution Control Commission did respond and I quote, "The acid rain question is an environmental, social, economic, and political question that can not be solved by one state alone and must have action by the Congress and leadership from the U.S. EPA."

I believe that is an excellent summation of where we are. I want to assure this Committee that I plan to work very hard to obtain a solution which is fair to Montana. The information that I have gathered has convinced me that the people of this country are looking for the leadership to solve the acid rain dilemma. I believe that if this Committee is willing to address the regional concerns of every region of this country, we can pass that legislation.

MAX BAUCUS
MONTANA

WASHINGTON, D.C.
(202) 224-2651

MONTANA TOLL FREE NUMBER
1-800-332-6106

United States Senate
WASHINGTON, D.C. 20510

February 10, 1984

Honorable Robert Stafford
Chairman
Committee on Environment
  and Public Works
U.S. Senate
Washington, D.C. 20510

Dear Bob:

During questioning at the Committee's hearing on acid rain held February 9, 1984, Senator Durenburger made a statement that the Montana Power Company from my home state was in favor of a national emissions tax. He based his statement on testimony that was presented at a hearing held by the Committee on August 25, 1983 in Roseville, Minnesota.

I would like to clarify the hearing record in this regard. Montana Power Company has indicated to me that they oppose an emissions tax, a generation tax, or any proposal that would shift the financial burden from the sources whose emissions are greater and which directly contribute to the problem.

I request that the Montana Power Company's letter to me, a letter from Montana Power Company to Senator Durenburger and a copy of their testimony from the Roseville hearing be inserted in the February 9, 1984 Committee's hearing record. I would like to also call to your attention the portion of their testimony specifically addressing the tax question. I refer you to the bottom six lines on page one of their testimony at that hearing.

With best personal regards, I am

Sincerely yours,

MONTANA POWER COMPANY mpc GENERAL OFFICES 40 EAST BROADWAY BUTTE MONTANA 59701 • TELEPHONE 406/723 5421

JAMES A. ROCK
Washington Representative
1730 M Street, NW · #607
Washington, D.C. 20036
(202) 29[redacted]

February 9, 1984

The Honorable Dave Durenberger
United States Senate
375 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Durenberger:

During the Environment and Public Works hearing on Acid Rain this morning you made reference to Montana Power Company's position on a national emissions tax and that we had supported such a tax at the hearing you held in Roseville, Minnesota last August 25.

I have enclosed a copy of the statement we made at that hearing. I have highlighted the portion of that statement on the first two pages dealing with the emissions tax question. As a matter of fact we testified IN OPPOSITION to such a tax. We remain opposed to such a tax. I have also enclosed a copy of a recent letter to Senator Baucus on this same subject and have highlighted the relevant portion.

We would appreciate it if you would see that the record of the Hearing is corrected in this regard to reflect our position taken in Minnesota and which we still maintain. To our knowledge Northern States Power is the only utility to indicate support for an emissions tax.

If we can provide any further information please let me know.

Best regards.

Sincerely,

James A. Rock

James A. Rock
Washington Representative

JAR/kc
cc: Senator Baucus
Enclosures

MONTANA
POWER
COMPANY
GENERAL OFFICES 40 EAST BROADWAY, BUTTE, MONTANA 59701 • TELEPHONE (406) 723-5421

W. P. SCHMECHEL
PRESIDENT and
CHIEF EXECUTIVE OFFICER

February 6, 1984

The Honorable Max Baucus
United States Senate
Washington, D.C. 20510

Dear Senator Baucus:

On numerous occasions in 1983, Montana Power expressed deep concern over acid rain legislation being considered in Congress. We appreciate the opportunity your questionnaire provides to enlarge upon our previous comments. As you know, I have testified before your Senate Committee on Environment and Public Works regarding acid rain and other clean air issues. Also, I presented our concerns to you and your staff personally. These concerns are founded upon our belief that several of the legislative proposals would impact harshly upon ratepayers served by Montana Power.

Montana Power opposes any national cost-sharing proposal which would tax or charge utilities in any manner and shift the financial burdens from the sources contributing to the problem.

Responsibility for emission reductions should be placed directly upon the individual sources. We question the logic or equity of proposals which would spread the costs over all parts of the country. Coal-fired power plants in Montana and other western states are already required to install air quality controls at enormous expense, and you have seen our accomplishments at Colstrip to meet Class I standards.

Based on studies that already are part of the record, I am convinced that the necessary reduction goals can be met by continued implementation of the Clean Air Act. As obsolete plants are decommissioned, replacement plants will be required to meet those standards. This gradual approach will reduce emissions without burdening our economy and society unduly. This assumes, of course, that states proceed diligently to adopt realistic implementation plans.

Federal requirements should not mandate or dictate the technological means, such as scrubbers, for achieving emission reductions. If reductions are imposed, flexibility and freedom of choice are the keys to achieving those reductions at the least cost.

Mandated specific control methods also discourage the use of new and developing technologies. In this regard, as you know so well, magnetohydrodynamics (MHD) is one technology that continues to hold out great promise for much cleaner and more efficient burning of coal. Congress should support and encourage continued research and commitment to MHD and other innovative technologies through any acid rain control legislation.

There is no doubt that acid deposition is a problem in specific regions of the United States, particularly in the Northeast. However, the extent and causes of the problem are not clearly known. The many and varied opinions are based upon inconclusive and controversial data. In any case, it does not appear that acid deposition is a problem in the West, and most certainly not in Montana. Where damage has been identified, efforts to take corrective action should be supported by Congress. Otherwise, government and industry should accelerate funding and research programs substantially.

If the goal of this clean air program is to reduce emissions, principles of equity and longer range potentials should help formulate acceptable legislation. We would be pleased to further discuss the acid rain issues with you if you have questions or comments.

Sincerely,

W. P. SCHMECHEL
President and
Chief Executive Officer

WPS/EFB4D/jff

BEFORE THE U. S. SENATE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

AMENDMENTS TO THE CLEAN AIR ACT

STATEMENT

OF

THE MONTANA POWER COMPANY

BY

EDWARD F. BARTLETT

AUGUST 25, 1983
ROSEVILLE, MINNESOTA

August 25, 1983

STATEMENT
OF
THE MONTANA POWER COMPANY

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I am Edward F. Bartlett, an attorney of The Montana Power Company. I reside in Butte, Montana, headquarters for the Company.

Montana Power is an investor-owned electric and gas utility operating in the western two-thirds of Montana. Our service area consists of about 107,000 square miles. Over 80% of the total population of the state live in our service area.

To serve Montana Power's 232,000 electric customers, the Company owns and operates 13 hydroelectric facilities and five coal-fired thermal electric plants. Montana Power has current total electric capability of about 1,103,750 kilowatts from thermal and hydro sources. The thermal contribution is about 53% of this total capacity.

The Montana Power Company and its wholly owned coal mining subsidiary, Western Energy Company, are deeply concerned about acid deposition legislation now being considered by Congress and the potential negative impact of this legislation on ratepayers served by Montana Power as well as electric consumers served by customers of Western Energy. Acid deposition must be recognized as a problem in specific regions of the United States, particularly in the Northeast. Montana Power supports accelerated research with mitigation and possibly legislative action that will lead to correction of these acid deposition problems. We believe, however, that development of any such legislation should adhere to certain common-sense principles.

Coal-fired power plants in Montana and other Western states are already being required to install technological controls at enormous expense. These controls were imposed despite the relatively lower emission levels in the region due to use of low sulfur fuels and significant use of hydro and nuclear electric generation. Electrical users in the West are already paying for these controls and their operation and maintenance. These costs have been borne by the utilities and their customers; as those costs are likewise borne by sources in other regions which have been required to reduce emissions. We can see no equity in proposals to spread the costs of emission reductions beyond the individual source. We oppose a national fee or tax on utilities, consumers, fuel or other proposals that would shift the financial burden from the sources whose emissions are greater and which directly contribute to the problem.

HR 3400 raises serious questions of equity to Montana's and many other states' ratepayers and utilities in that it imposes a "user fee" on all electric power produced. The costs of pollution control equipment in existing facilities is or will be included in the rates for electric service. In addition to paying these costs, under HR 3400 the consumers would be required to share the financial burdens of paying for scrubbers installed in other states. In essence, our customers and company would pay both for environmental quality in Montana and for reducing emissions in the Midwest. Montana customers would pay $7.7 million yearly if the HR 3400 proposed 1 mill user fee were imposed today. We oppose this legislation as inequitable and illogical.

In Montana, we are burning low sulfur coal, as well as employing scrubber technology. A brief survey of the Montana Power coal-fired generating plants reflects that a combination of appropriate technology and the use of relatively low sulfur coal is successful in controlling sulfur dioxide emissions. The emission figures are approximate average emissions assuming operations at full capacity. Our release of sulfur dioxide from Colstrip Units 1 and 2 in eastern Montana averages 0.3 pounds SO_2 per million Btu. These units, as well as the larger Units 3 and 4 which will be in commercial operation in 1984 and 1985, utilize Venturi wet scrubbers for air pollution control. Colstrip Units 3 and 4, which are owned by Montana Power and four other Northwest utilities, will release only 0.07 pounds SO_2 per million Btu. These facilities are well within the federal new source performance standards of 1.2 pounds SO_2 per million Btu. The costs for the air pollution control equipment for Units 3 and 4 is $500 million, which is almost 35% of the total Colstrip 3 and 4 generating plant expenditures.

The attainment of air quality standards has been and will be expensive. We calculate that the cost to customers to cover the fixed charges of our Colstrip 3 and 4 pollution facilities will amount to 11 mills per kilowatt hour, while the loss of energy to operate these facilities will add another 2 mills per kilowatt hour. This environmental cost represents about 25% of the current average retail price our residential consumers pay. It is extremely difficult to envision a scenario in which we or our customers would endorse being assessed to pay for someone else to accomplish what we in the West have accomplished without soliciting contributions.

While we advocate that those primarily responsible for the emissions should pay the primary costs, we believe those costs must be fairly and equitably spread throughout all contributing industrial and mobile sources in the affected area. Further, credit should be given for emission improvements already in place, and costs of reductions by utilities should and must be fully recoverable in rates.

The determination of causes, extent and remedies requires significant research efforts. Regardless of conflicting evidence, unbalanced publicity has resulted in a public perception that acid rain is a serious manmade threat. The foremost need is to obtain the data to resolve the scientific differences of opinion, as quickly as possible, so that rational solutions can be designed and implemented to deal with any real problems that might be confirmed.

One of the disturbing aspects of the acid deposition control measures under consideration is abandonment of the basic principle established in the Clean Air Act Amendments of 1970 that health and welfare are to be adequately protected through scientific consideration of cause and effect. Science, technology, economics, energy and all other relevant factors should not be ignored by placing an arbitrary prohibition on any new emissions.

A cap or rollback on emissions would have long term negative social and economic impacts. The effect of placing a cap on emissions would be commiting our economy to a period of stagnation with no industrial and economic growth.

Montana Power Company believes that a program aimed at controlling acid deposition must be carefully structured to address the regional nature of the problem. Moreover, any remedial action must be reasonably implemented to ensure that control measures produce benefits corresponding to their costs.

Overall costs of reductions in emissions to reduce acid rain are estimated in the billions of dollars. To the extent that controls are phased-in corresponding to research results and to the extent that sources are permitted flexibility in achieving emission reductions, the costs can be minimized. Major initial reductions in sulfur dioxide emissions from coal-fired power plants can be achieved through coal cleaning, fuel blending or voluntary operating restrictions. Sources should be provided the flexibility to decide how best they can meet emission limitations at the lowest possible cost. Federal requirements should not dictate specific technological means, such as scrubbers, for achieving emission reductions.

Any legislation enacted should also encourage the use of new and innovative technologies which offer possible alternatives for the post-1990 period. The addition of new generation methods to the electrical production mix in the 1990s would offer a more effective use of capital over the long run than requiring the addition of costly scrubbers to older plants, particularly when these emerging technologies may produce environmental benefits within 10-12 years that are far in excess of benefits from retrofit scrubbers.

In this regard, magnetohydrodynamics (MHD) is one technology which holds out great promise for much cleaner and more efficient burning of coal. While significant research and development remains to be accomplished, a national commitment to the MHD technology in any acid rain control legislation would be a positive contribution by Congress to energy conservation and affirmative environmental action.

Perhaps of even greater significance at this time is the increasing evidence that any emissions reduction program would be of doubtful effectiveness. A recent study of the Energy Laboratory at Massachusetts Institute of Technology concluded that elimination of all sulfur dioxide emissions from all power plants would have very little effect on expected rainfall acidity. One might conclude, from this study, that proposed massive and expensive control programs will not achieve any environmental improvement.

Many studies indicate that local emission sources play a critical role in acid deposition. The most effective solution would seem to be local control of principal emitting sources near identified sensitive areas.

Thank you for the opportunity to present our views.

STATEMENT OF MICHAEL S. DUKAKIS, GOVERNOR, COMMONWEALTH OF MASSACHUSETTS

Mr. Chairman, Members of the Committee, I appreciate this opportunity to speak to you about a subject of urgent concern to the people of Massachusetts. Members of my Administration have literally spent thousands of hours not just working for acid rain legislation, but also researching the scientific and policy issues that must be dealt with when adopting an acid rain control program.

Acid precipitation, most commonly known as "acid rain," has been associated with human activity since the onset of the industrial revolution. However, at the present, acid rain has become so widespread and intense that it has gained regional, national, and international attention. Severe acidic precipitation is capable of adversely affecting aquatic and terrestrial ecosystems as well as cultural resources.

Massachusetts is receiving some of the most intense acidic precipitation in North America. Aquatic and terrestrial ecosystems and cultural resources experience prolonged exposure to acid precipitation and they are thus highly susceptible to damage. Moreover, soils and bedrock of the Commonwealth are low in acid neutralizing capacity.

Acid rain is produced by sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions generated from the Midwest and the Atlantic seaboard states. Even if Massachusetts and other states in the Northeast were to further reduce SO_2 and NO_x emissions, major emission reductions would have to be made outside the region to significantly decrease the intensity and the consequences of acid rain in Massachusetts.

Acid rain is causing severe damage to many of our lakes, ponds, and streams. Initial tests done by Dr. Paul Godfrey at the University of Massachusetts have shown that more than 80% of the 1,173 bodies of water sampled are threatened by acid rain. Twenty percent, including the Quabbin Reservoir—the water supply for Metropolitan Boston, are dangerously close to losing their capacity to neutralize acid precipitation. These samples were taken in April of 1983 and represent one-quarter of the water resources in Massachusetts.

Many of the lakes, ponds and reservoirs in Massachusetts have undergone acidification and have become more aggressive, i.e., more likely to leach heavy metals into the water, because of acid rain. Elevated levels of toxic/heavy metals found in drinking water are a threat to human health. It is for this reason that we are forced to spend over $1 million annually to treat drinking water supplies such as Quabbin Reservoir.

A conservative estimate of current economic cost due to losses to recreational fishing and related tourism alone in New York and New England is $20-25 million per year. Current fisheries' damage is small when compared to the potential damage to fisheries occurring in vulnerable aquatic resources throughout New England.

While damage to aquatic systems is well documented, the effects of acidic deposition on terrestrial systems are more complex and difficult to assess. Scientists are willing to speculate that terrestrial ecosystems are adversely affected by acid rain but the mechanisms are not known. In this class of acid rain effects we should look to information available from European countries which I will describe later.

Natural ecosystems are not alone in suffering the consequences of acidic deposition. Cultural resources such as historical buildings and statues are also vulnerable to damage. These resources are suffering irreversible damage and loss of detail from effects of acidic precipitation. Acidic rainfall (with low pH) containing sulfates and nitric oxides accelerates erosion and corrosion problems. Paints are worn away more quickly and textiles decompose at a faster rate than normal. However, metals and masonry, such as bronze, limestone, marble, and sandstone which are used in sculpture, art and decoration are the most vulnerable materials.

We have recently found that the Europeans are far ahead of us in understanding the acid rain problem.

Less than one month ago, Lt. Governor John Kerry and Commissioner of the Department of Environmental Quality Engineering, Anthony Cortese traveled to five European countries, including Norway, Sweden, Germany, Belgium, and England. They met with over 60 officials from government, industry, and environmental groups during that trip. What they learned was astonishing. The European experience is one that we can all learn from.

The European damage has reached a point where the 24 member European Economic Community is now proposing a 60 percent reduction in sulfur dioxide emissions, a 40 percent reduction in nitrogen dioxide emissions, and a 40 percent reduction in particulate emissions, all to be accomplished by 1995.

The lessons to be learned from the European experience are clear. In Europe the first signs of the effects of acid rain were seen in the lakes of Scandinavia. Those first signs became the subject of considerable debate about the mechanisms that caused the damage. Now damages are recognized all across Europe, including significant forest damage in West Germany. The finding that forest damage in West Germany was at least in part related to acid rain spurred that country to action and in turn the European Economic Community to propose major emission reductions.

I can only wonder what it will take in this country to convince national policy makers that the emissions that cause acid rain must be acknowledged that we need an acid rain control program.

We should learn from the Europeans that acid rain is not only a matter of dead lakes and dead fish. Acid rain is responsible for decreased visibility, for damage to historic buildings and monuments and materials in general, and increased health risks due to fine particulates in the air. You simply cannot measure the cost of damages due to acid rain in terms of dollars per pound of dead fish as some people would have you do.

We need not even look to Europe to find damages from acid rain that extend beyond our lakes. It has been reported that a recent study done for the Environmental Protection Agency demonstrated that a 12 million ton reduction in sulfur dioxide emissions in a 31 state area would accrue a $4 billion per year benefit by increasing visibility. Significantly, the greatest gains in visibility would be in the midwest where there would be an estimated improvement in visibility of at least 22 percent.

Because acid rain is having such a profound impact on Massachusetts and the Northeast in general. I established an Acid Rain Work Group to advise me on state, regional, and national control policies and to keep me informed of the views of the many constituencies which have an interest in acid rain. Participants include industry, environmental groups, utilities, and labor. Out of this intensive effort grew a set of principles which form the basis for a comprehensive control plan.

Given the guidance received from the Massachusetts work group we have been active participants in a number of regional and national forums.

The long, hard discussions that have taken place within our state and with other states have produced a real understanding of the many points of view concerning various acid rain issues. The understanding that we have gained is embodied in the recently adopted policy positions of the New England Governor's Conference and the Coalition of Northeast Governors.

The acid rain control program contained in these policies, agreed to by eight governors, is sensitive to the many regional concerns in this debate. For example, the control program would be paid for by a national fund to ease the cost burden in the Midwest. Each of the features of the plan was carefully constructed to respond, as much as possible, to the concerns of other regions.

The one element of the plan that is absolutely necessary from our perspective is the call for major emission reductions to be completed by 1955. If we are to minimize and eventually prevent continued damage to our environment, large scale reductions must begin now.

Our efforts to reach a consensus through regional organizations and the National Governor's Association are particularly important since even though the Reagan Administration acknowledges that acid rain is a problem, it continues to insist that the solution is to spend more money on research. Certainly added research will fine tune our understanding of the physical and chemical processes related to acid rain; however, what is needed is a control program. The administration has abdicated its responsibility to act affirmatively on this national problem that only the federal government can solve.

In conclusion, let me briefly talk about another argument that is frequently raised as a reason why we should not control acid rain now. That argument is that it will cost too much to bring about control. I have attached to my testimony a recent letter to me from the president of the Boston Edison Company. In that letter, Boston Edison commits itself to the installation of flue gas desulfurization as part of a proposed coal conversion project. Edison reports that "It must be recognized that scrubbers will increase the overall cost of the project."; but "We are convinced that coal conversion is still the best method available to us to provide customers with reliable and least cost electricity." According to Edison's estimates, they can convert from burning low sulfur oil to the use of relatively high sulfur coal with flue gas desulfurization equipment and over the long run lower the cost of electricity to Massachusetts consumers. I hope you will consider those facts if you are told that acid rain controls will be too costly.

The issue is not whether it is too costly to control emissions that cause acid rain. Rather, the issue is whether it is too costly not to control those emissions. The damages that the Europeans have seen, and the mounting evidence of damages that is being accumulated in the United States clearly says that we must control emissions; and we must do it now.

Mr. Chairman, I ask that the letter from Boston Edison and a copy of the New England Governors'/CONEG acid rain control plan be included in the hearing record.

STATEMENT OF
BOARD OF DIRECTORS
TENNESSEE VALLEY AUTHORITY
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
FEBRUARY 9, 1984

We are pleased to be here today in response to your invitation to present our views on one of the most serious environmental problems facing us and future generations. Acid rain is potentially a slow and quiet danger, that could subtly alter the web of forest and aquatic ecosystems. Scientists believe that emissions created by combustion of fossil fuel are a major culprit in the creation of acid rain. The problem is international and has potential for widespread environmental damage.

Because of our multifaceted mission, TVA has a unique perspective to share with you as you decide what action to take. TVA is a corporate agency and instrumentality of the United States; the Nation's largest producer of electricity; one of the Nation's largest coal consumers; and one of the largest emitters of SO_2, the pollutant which has been most often identified with formation of acid rain. We are also responsible for helping protect the waters and forests in the Tennessee Valley, for stimulating economic development in the Tennessee Valley region, and for promoting the wise use of its natural resources--responsibilities that go far beyond producing power. TVA has over 50 years of experience in reconciling apparently conflicting interests and solving interrelated energy and environmental problems.

As a federally owned producer of electric energy, TVA believes that its role is to serve as a leader in the electric utility industry in seeking solutions to national problems. We have often been successful in combining our special responsibility to pursue a broader public interest with our technical, real-world-of-business perspective and bring them both to bear on public issues such as acid rain. It is in this spirit that we offer our observations.

TVA Position

TVA is not in accord with the program of the President. It represents the opinion of the TVA Board. Simply put, our position on acid rain is that a reduction in acid precursors is essential in eastern North America, and that Federal legislation is necessary to accomplish this. Reductions should be required of all significant emitters of SO_2, both utilities and other industries. These SO_2 reductions should be allocated to the States proportionally to their total SO_2 emissions for the 1980 base year. States should have flexibility in allocating their required emissions reductions.

TVA believes in the principle that the polluter should pay, and we practice what we preach. The costs of further reduction should be borne by the polluters and thus passed on to consumers. Maximum flexibility should be given to emitters to select the most cost-effective way to reduce their emissions. If acid rain legislation is structured in this way, we estimate the increased cost to TVA rate-payers could be about 4-6 percent for our share of a 12-million ton national reduction. We stand willing to do our fair share in any cleanup effort.

Acid Rain Research

Acid rain is too often thought of as a regional problem, confined to the northeastern United States and eastern Canada.

However, we have rainfall in the Tennessee Valley whith is as acidic as that found anywhere in North America. Based on a monitoring program which began in 1971, we know that on an average annual basis our rainfall is in the pH 4.1 to 4.4 range--typical of the values for New England, and we get much more rainfall than New England. The pH of rainfall at monitoring sites remote from our fossil-fired generating plants is similar to that which falls at monitoring stations at the plants themselves. While our data do not show any trend toward increased acidity, comparative data for the eastern United States between 1955 and 1973 do indicate a trend toward decreased levels of pH and increases in the aerial extent of low pH rainwater. These data are of particular concern to us because most of the increase seems to be toward the Southeast.

While we have no direct evidence of a link between acid deposition and impacts to resources in our region, several observations over the last several years could be related to acid deposition. We have found, for example, that after rainfalls the pH levels of some streams are depressed to the extent that aquatic life could be adversely affected. Our initial research indicates that in one particular watershed the acidic nature of the soils appears to be the probable cause of the pH depression. We have also observed fishkills at trout rearing facilities, unusually high incidences of skeletal deformities in smallmouth bass in several reservoirs, and a decline in the range of the native Appalachian brook trout over the last two decades. These observations could be linked to acid rain, although pesticide and herbicide runoff and natural soil acidity are also possible causes for some.

Some possible terrestrial effects also have been observed. We have recently become aware of a problem with increased mortality and decreased vigor of trees in the Valley region that began about 20 years ago. Core samples show a buildup of heavy metals in the trees associated with this condition. The cause of this widespread problem has not been determined. There are scientists, both within TVA and outside, who believe that acid deposition could be a causative factor.

Appendix A gives additional information on these observations and on the TVA acid rain research program.

TVA Cleanup

TVA has just completed the largest air pollution cleanup effort by a single emitter in U.S. history. In the past six years TVA cut its SO_2 emissions by 56 percent, from 2.3 million to 1 million tons per year, and particulate emissions by 100,000 tons or over 90 percent. The total investment so far has been $927 million. The annualized cost is about $346 million in 1984 dollars. This emission reduction program, which brought TVA into compliance with the Clean Air Act, utilized a number of control approaches, including advanced coal washing, installation of scrubbers, and fuel switching to lower sulfur coal. Further emissions reductions have been achieved as a result of increased emphasis on energy conservation. The entire cost, we should stress, was paid by TVA ratepayers, whose electric bills increased about 9 percent as a result of these efforts. Appendix B gives more detail on our cleanup efforts to date and their cost.

We think that additional cleanup of emissions can be accomplished at reasonable cost to our ratepayers. An appendix to this statement (Appendix C) outlines the projected range of costs and the assumptions used to arrive at them. We estimate that TVA rates would have to be increased by an additional 4-6 percent by 1995 if we reduced our emissions by as much as 50 percent below present allowable levels. This reduction would represent TVA's fair share of a 12-million ton reduction from total utility and nonutility 1980 SO_2 emissions in the eastern 31 States. We estimate that our rates would have to be increased by no more than 4.2 percent to achieve our share of a 10-million ton goal if Congress enacted the legislation.

While each utility system's unique characteristics make it difficult to generalize, TVA's recent experience is useful from several perspectives. For one thing, it illustrates the advantage of applying the most flexible methods to achieve emission reductions. This means that in addition to having the flexibility to select the lowest cost emission control methods at particular plants, we could also take into account methods for reducing coal-fired generation on our power system. Our energy conservation efforts are a good example. These efforts are designed to eliminate the need for new capacity and thereby reduce the cost of electricity to the TVA ratepayer. By 1990 we expect our conservation efforts to reduce our generating capacity requirements by 3,000 MW with a saving of 5.7 billion kWh. Generating those 5.7 billion kWhs by coal-fired steam plants would have increased our annual SO_2 emissions by 90,000 tons. Each kWh saved is a cost-effective investment for us, compared to the alternatives of building new capacity, and we get the added benefit of not having to control those additional emissions.

Our experience also suggests that the cost of compliance by other electric systems with any additional emissions reductions required to control acid rain may be overestimated. In evaluating the estimates of the increased cost to consumers of acid rain controls, TVA's own estimates for its system are instructive. The TVA system is in the heart of the high sulfur coalfields and TVA emissions currently are close to the average of all utilities in the 31-State area. Thus, estimates that TVA ratepayers would experience no more than a 6 percent increase for its fair share of a reduction in the 31-State area of 12 million tons should be a useful benchmark. TVA's costs are influenced by the reliance on existing non-SO_2 emitting generating capacity and our plans to complete construction of four additional nuclear reactors by the end of this decade. But, while the rate impacts on utilities which rely on coal for a smaller or larger portion of their generation could be smaller or larger, TVA's annual costs of reducing emissions as indicated in Appendix C should be representative of realistic costs for these levels of reduction.

We further believe that any costs necessary to clean up the air should be borne by those who are causing the problem. The principle that the polluter should pay for cleaning up is sound economics and is built into the basic environmental regulatory framework we have established in this country. Departing from it, as some have advocated for acid rain, would, in our opinion, set an unfortunate precedent. Subsidies for polluters would send the wrong signals to utilities and their consumers about the true cost of generating electricity, and such wrong signals can only lead to more wasteful use of electricity and a higher level of pollution. We would urge the committee to avoid any type of special subsidy for the cleanup effort, as you did in the legislation reported last session.

Technology Research

TVA has done pioneering work in SO_2 emissions control technology since the late 1960s, and our major role in flue gas desulfurization development began in 1972 with the construction of three 10-MW pilot plants at our Shawnee Steam Plant in Paducah, Kentucky. Since then, more than $35 million has been invested by the Environmental Protection Agency, Electric Power Research Institute, the Department of Energy, TVA, and others at this facility. Numerous technology advancements are available today because of this effort. For example, developments in forced oxidation and waste disposal will enable us to retrofit these technologies into the full-scale scrubbers at our Widows Creek units 7 and 8. We are also active in preparing technology assessments and cost estimates for both recovery and throwaway processes. These estimates are quoted throughout the industry.

Today, our efforts are also focused on demonstrating Atmospheric Fluidized Bed Combustion (AFBC) which we think holds the greatest promise for the future of high-sulfur coal. TVA projections indicate that a new AFBC boiler fueled with Illinois-basin, high-sulfur coal will produce electricity at a cost 10 to 20 percent less than a conventional plant with scrubber. Such a plant could achieve greater than 90 percent sulfur removal and would produce less oxides of nitrogen than a conventional plant. This projection is based on our experience with the AFBC 20-MW test facility which we have operated for almost two years.

TVA has taken the lead in a cooperative development with the Electric Power Research Institute, Duke Power, the State of Kentucky, and others in designing and demonstrating a commercial-size plant. Of the $220 million required $30 million is being provided by the Federal treasury. We are now designing the plant and if all goes well, this technology should be commercially available in the 1990s.

TVA is also actively pursuing dry flue gas desulfurization technology (commonly known as spray dryer) on high sulfur coal at the Shawnee Steam Plant. Two pilot plants supplied by different vendors are providing critical data necessary to adopt this technology in the eastern United States. We are considering a larger, commercial scale demonstration of this technology.

Other technologies that need further development or demonstration include double alkali using limestone, limestone injection multiple burner; lower cost recovery systems, retrofittable technologies for existing outdated limestone scrubbers, and combined NO_x/SO_2 removal processes.

TVA is also involved in research to improve our technology for removing sulfur from coal. For example, we are demonstrating at our Paradise Steam Plant high gradient magnetic separation technology which improves Btu recovery and sulfur reduction in the fine coal washing circuit. We are conducting research on oil agglomeration and magnetite recovery processes which recover clean coal from fine coal refuse and extract magnetite from fly ash, respectively.

Additional research is needed to develop some cost-effective chemical coal cleaning technology that may be tailored to remove almost any desired amount of sulfur from coal, especially for those cases where greater than 50- to 60-percent reduction in sulfur is required.

Research and development of this type, along with various synthetic fuel processes, provide hope for the future of the high-sulfur coal industry.

Conclusion

Mr. Chairman and members of the Committee, we recognize that you have been among the most responsible and farsighted in dealing with the acid rain problem and we commend you for it. Any increase in costs arising from a control program will be painful, but these increased costs need to be put into perspective. Compared to the costs which ignoring the acid rain problem may impose, these costs are reasonable. The bill you reported in the last Congress still stands as the high watermark in the overdue effort to control acid rain. We think the American people strongly support taking positive legislative steps to clean up our air and not run the risk of greater damage from acid rain.

The majority of the TVA Board supports legislation now to achieve a 10-12 million-ton reduction in SO_2 over the next decade in a cost-effective manner and without subsidies of any kind, but the Chairman prefers to wait until EPA recommends a level of national SO_2 emissions with the understanding that TVA would meet its fair share of the reductions at that time.

Mr. Chairman, we would be pleased to address any questions you or other members of the Committee may have.

APPENDIX A

ENVIRONMENTAL EFFECTS IN THE TENNESSEE VALLEY

The Tennessee Valley Authority (TVA) recognizes that acidic deposition can contribute to long-term damage to sensitive ecosystems. It is evident that scientifically assessing acidic deposition impacts is extremely complex, and establishing strict cause-and-effect relationships may not be possible. Nevertheless, TVA believes that acidic deposition is one of several factors involved in documented effects on Tennessee Valley forests, waters, and fish. Although we have no direct evidence of a link between acidic deposition and impacts to the resources in the Tennessee Valley, certain observed conditions have led us to the conclusion that acidic deposition could be a significant threat to the Tennessee Valley's environment.

Forests

- o Altered growth patterns and declining productivity of red spruce, shortleaf pine, hemlock, hickory, yellow birch, pitch pine, and Fraser fir in the Great Smoky Mountains National Park.

- o Changes in the present mix of tree species.

- o Increased susceptibility of some tree species to damage by insects and disease.

- o Changes in the availability of essential nutrients and increased availability of toxic metals in the soils.

Water Quality

- A trend of increasing acidity and decreasing alkalinity in high elevation streams in the Southern Blue Ridge Province.
- Short-term acidification of surface waters following heavy rains.
- Acidic conditions in reservoirs in the Southern Blue Ridge Province.

Fisheries

- Unusually high incidence (up to 28 percent) of spinal deformities in smallmouth bass collected from Chatuge Reservoir in north Georgia and Fontana Reservoir in North Carolina.
- Mortality of fish in fish hatcheries supplied with water from various streams draining the Great Smoky Mountains National Park following heavy rains.
- Decline in the range of native Appalachian brook trout in mountain streams of the Southern Blue Ridge Province.

TVA RESEARCH ON ACID DEPOSITION EFFECTS

The objective of TVA's acid deposition research program is to determine (1) what damages are occurring or are likely to occur in the Tennessee Valley region as a result of acid deposition and (2) what can be done to mitigate damages. This research will provide:

1. An assessment of the extent and magnitude of any damages.
2. An understanding of the processes responsible for these damages and a basis for mitigative action.
3. A baseline of information on acid sensitive regions for evaluating the effectiveness of mitigation and control measures.

Current and past efforts of TVA staff have shown that the aquatic and forest resources of the Blue Ridge Province of the Southern Appalachians have the highest potential for adverse impact in the Tennessee Valley. Therefore, TVA's research focuses on an assessment of damage to these resources and detailed investigations of identified problems in this sensitive region.

The following summarizes TVA's current acid deposition research in forestry, water quality, fisheries, and atmospheric processes.

Forestry

Forest Inventory Statistics--Trends in forest productivity are being assessed in the upper Tennessee Valley watersheds. Mortality and growth are being assessed based on productivity statistics from 125 forest plots routinely surveyed between 1960 and 1975.

Impacts of Forest Soils Chemistry on Surface Water Quality--Laboratory studies are being conducted using soil samples from watersheds in the Southern Blue Ridge Province to determine the influence of soils chemistry on the acidification of surface waters.

Impacts of Acid Precipitation on Forest Soils--Existing data are being used to determine the significance of human inputs of acidity, natural internal production of acidity, and the contribution of tree harvesting to nutrient losses from forest soils; and to evaluate present and future adequacy of soil nutrients for sustained forest productivity. The Department of Energy (DOE) is funding this project.

Forest Soils Hydrology--Upper elevation slopes have been instrumented to quantify flow rates through soils during rainfall. The chemistry of soil solutions and stream samples is also being measured.

Nitrogen Deposition on Forested Watersheds--Nitrogen input via wet and dry deposition and output via streamflow at three forested watersheds with potentially different nitrogen loading rates and proximities to coal-fired power plants are being quantified and compared. Impacts of atmospheric nitrogen deposition on nutrient cycling in forested watersheds are being determined. The Electric Power Research Institute (EPRI) is funding this project. This study complements a similar TVA study of sulfur deposition, funded by the U.S. Environmental Protection Agency (EPA), conducted at two of the three watersheds.

Evaluation of Simulated Acid Precipitation Effects on Forest Ecosystems--Foliar leaching rates and plant nutrient content, leaf physiological and morphological responses, decomposition rates in litter and mineral soil, and leaching rates of soil nutrients are being determined using experimental forest microcosms. Microcosms containing trees and acid sensitive soils have been subjected to simulated acid rain treatments of 3.5, 4.0, 4.5, and 5.7 annual average pH for a two-year period. EPRI is cofunding this project.

Terrestrial Impacts of Acidic Deposition on Deciduous Forests in the Tennessee Valley Region - Modeling Input/Output Relationships--Existing data on sulfur flux to and through forest systems, collected as part of the EPA/TVA passthrough program, are being combined with other meteorological, coal analysis, and coal consumption data generated by TVA along with NOAA radiosonde data to develop a predictive model. The model will relate atmospheric acidic loading and deposition to nutrient cycling in forest ecosystems and will project impacts on forest productivity. DOE is funding this project.

Aluminum Biogeochemistry of Forested Watersheds--The major environmental parameters controlling the release, transport, and toxicity of aqueous aluminum in the natural environment will be identified and quantified, and the interactions between aluminum biogeochemistry and acidic deposition will be analyzed at a watershed in east Tennessee. This project is funded by EPRI.

Water Quality

Trends in Water Quality of Streams and Reservoirs--Water quality surveys of streams and reservoirs in the potentially acid sensitive regions of the Tennessee Valley are being conducted. This long-term program will monitor trends in water quality for future assessment of the effectiveness of acidic deposition controls. EPA is cofunding this project.

Assessment of Recent Trends--Statistical techniques are being applied to previously collected water quality data to assess recent trends in acidification of surface waters.

Reservoir Water Quality and Sources of Acidity--Reservoir conditions that affect pH and trace metal concentrations of concern to fisheries are being evaluated by periodic sampling of selected reservoirs. The relative contributions of various sources of acidity and trace metals to documented acidic conditions and fisheries concerns are being determined.

Fisheries

Response of Smallmouth Bass--The response of smallmouth bass to known transient water quality conditions (pH and aluminum) resulting from snow melt or storm runoff is being evaluated. This project is being conducted with EPA funds.

Skeletal Deformities in Smallmouth Bass in High Elevation Reservoirs--The smallmouth bass physiology, toxic metals and pesticides burdens, and water chemistry of high elevation reservoirs are being investigated to determine the cause and extent of the skeletal deformity problem.

Atmospheric Processes

Atmospheric Dispersion--Photochemical reaction chamber experiments, utilizing flue gases from the operating power plant and surrogate mixtures, are being conducted to simulate production cf sulfate and nitrate aerosols and ozone under varying rural and urban atmospheric conditions. Results are being used in developing predictive models for assessing the contribution of existing or proposed TVA coal-fired power plants to local and regional air quality, and for developing effective control strategies.

Air Quality Modeling Technology Research--Air quality models for estimating the local, regional, and interregional air quality impacts of proposed and existing air-pollutant-emitting facilities are being developed and modified. Impacts being investigated include effects caused by the production and long-range transport of acidic pollutants.

Deposition Monitoring--Wet/dry collectors are being used to monitor the long-term rates of atmospheric deposition. Six monitors are operated in the vicinities of coal-fired power plants and three monitors are sited in remote areas. Samples are collected biweekly and are analyzed for 14 parameters including pH, sulfate, nitrate, and weak and strong acidity.

APPENDIX B

TVA COMPLIANCE WITH THE CLEAN AIR ACT

INTRODUCTION

TVA is now in compliance with the consent decrees under the Clean Air Act. This has been a major achievement for TVA and has significantly improved the Valley's air quality.

Consent Decree Air Quality Control Requirements

Air quality control requirements under the consent decrees involved medium and low-sulfur coal, coal washing, SO_2 scrubbing, precipitators, and baghouses. New stacks were added at two facilities, Colbert and Johnsonville, to ensure that consent decree SO_2 emission standards maintain compliance with all ambient air quality standards at the plants. Prior to the consent decrees, only precipitators, new stacks, and one SO_2 scrubber had been added at the TVA steam plants as air quality control measures.

Table 1 outlines all air quality control measures at the 12 TVA steam plants before and under the consent decrees.

Consent Decree Costs

Air pollution control costs are expressed in terms of the capital expenditures that are involved as well as annual costs. Annual costs involve amortization of the capital expenditure along with operation and maintenance costs. The annual costs are of most interest since they can be related directly to electric rates. Prior to the consent decrees, TVA's air pollution control capital costs were $358 million for the 12 coal-fired steam plants. Consent decree capital costs were $927 million for a total of $1,285 million.

Annual costs for projects before the consent decrees were $43 million, and consent decree annual costs are $346 million for a total annual cost of $389 million (Table 2). The $346 million consent decree annual costs represent a 9 percent increase in electric rates.

Air Quality Results from Consent Decrees

The consent decree actions have resulted in improved air quality both in terms of emission reductions and improved ambient air quality. TVA steam plant system SO_2 emissions are given in Table 3 and show significant reductions under the consent decrees. Pre-consent decree SO_2 emissions were about 2 million tons of SO_2 per year. Under the consent decrees these emissions were reduced to about 1 million tons per year (Table 3). Plant-by-plant SO_2 and particulate emissions before and after most of the consent decree projects were completed are given in Tables 4 and 5. NO_x emissions are given in Table 6. Ambient SO_2 and particulate information are given in Tables 7 and 8.

Comparison of TVA and National Emissions

Now that the consent decree projects are completed, TVA SO_2, particulate, and NO_x emissions are expected to be about 1 million, .01 million, and 0.5 million tons per year, respectively (Tables 4 through 6). Total national emissions of these three pollutants are 26, 9, and 23 million tons per year for SO_2, particulates, and NO_x (Table 9). These data show the relationship between TVA and the rest of the utility industry to total national emissions of these three air pollutants.

Table 1

SO_2 and Particulate Compliance Methods

TVA Steam Plants

Plant	Compliance Methods	
	Prior to Consent Decree	Consent Decree
Allen	Precipitators	Medium sulfur coal
Bull Run	Precipitators	
Colbert	Precipitators	Medium sulfur coal, New Stack
Cumberland	Precipitators	Precipitators, coal washing
Gallatin	Precipitators	Precipitators, Medium sulfur coal
John Sevier	Precipitators	
Johnsonville	Precipitators	Precipitator upgrade, Medium sulfur coal, New stack
Kingston	Precipitators, New Stacks	Low sulfur coal
Paradise	Precipitators	Precipitator, coal washing, SO_2 Scrubbing
Shawnee	Precipitators, New Stacks	Baghouses, Low sulfur coal
Watts Bar	Precipitators	Medium sulfur coal
Widows Creek	Precipitators, New Stack, SO_2 Scrubbing	Low sulfur coal, SO_2 Scrubbing

Table 2

Air Pollution Control Costs and Consent Decree Completion Dates

TVA Steam Plants

Plant	Annual Costs (millions of '82 Dollars) Non-Consent Decree	Consent Decree	Total	Consent Decree Completion Dates
Allen	2	4	6	5/ 4/79
Bull Run	5		5	
Colbert	5	6	11	6/ 1/79
Cumberland	1	56	57	10/19/82
Gallatin	2	25	27	6/15/79
John Sevier	2		2	
Johnsonville	4	33	37	7/ 2/82
Kingston	10	18	28	6/29/79
Paradise		103	103	12/14/83
Shawnee	5	55	60	10/ 1/81
Watts Bar		–	–	7/ 2/81
Widows Creek	7	46	53	12/17/81
TOTALS	43	346	389	

Table 3

Total Annual SO_2 Emissions

TVA Steam Plants

Fiscal Year	Total SO_2 Emissions (Millions of tons)
1977	2.4
1978	1.9
1979	1.7
1980	1.6
1981	1.6
1982	1.2
1983	1.0

Table 4

SO_2 Emissions Information

TVA Steam Plants

Plant	SO_2 Emissions (1000 tons/year) FY 1977	SO_2 Emissions (1000 tons/year) After Consent Decree Compliance*	Consent Decree SO_2 Emission Standard (lb $SO_2/10^6$ Btu)
Allen	113	69	4.0
Bull Run	109	38	4.0
Colbert	229	135	4.0
Cumberland	363	216	5.0
Gallatin	155	134	5.0
John Sevier	96	75	4.0
Johnsonville	213	114	3.4
Kingston	178	94	2.8
Paradise	394	161	3.1
Shawnee	278	43	1.2
Watts Bar	34	18	4.0
Widows Creek	189	44	1.2
TOTALS	2,351	1,141	

---

*Projection based on FY 1981 coal receipts

Table 5

Particulate Emissions Information

TVA Steam Plants

Plant	Particulate Emissions (1,000 tons/year) FY 1977	After Consent Decree Compliance*	Consent Decree Particulate Emission Standard (lb. particulates/10^6 Btu)
Allen	1	.8	.10
Bull Run	38	.1	.11
Colbert	3	2.5	.12
Cumberland	6	3.3	.10
Gallatin	28	.1	.10
John Sevier	1	.4	.11
Johnsonville	2	.8	.10
Kingston	1	.5	.10
Paradise	13	.9	.11
Shawnee	9	.4	.11
Watts Bar	2	.6	.14
Widows Creek	60	1.2	.12
TOTALS	164	11.6	

---

*Projection based on FY 1981 coal burn rates

Table 6

NO_x Emissions Information

TVA Steam Plants

Plant	FY 1981 NO_x Emissions (1,000 tons/year)
Allen	43
Bull Run	21
Colbert	26
Cumberland	40
Gallatin	23
John Sevier	17
Johnsonville	29
Kingston	41
Paradise	139
Shawnee	29
Watts Bar	4
Widows Creek	31
TOTAL	443

Table 7

Highest 24-hour Ambient SO_2 Concentration

TVA Steam Plants

Plant	Highest 24-hour Average SO_2 Concentration (ppm)	
	1977	1981
Allen	.07	.16
Bull Run	.06	.03
Colbert	.17	.10
Cumberland	.10	.10
Gallatin	.18	.13
John Sevier	.10	.11
Johnsonville	.23	.13
Kingston	.10	.08
Paradise	.18	.18
Shawnee	.27	.09
Watts Bar	.13	.11
Widows Creek	.35	.18

Table 8

Highest 24-hour Suspended Particulate Concentrations

TVA Steam Plants

Plant	Highest 24-hour Suspended Particulate Conc. ($\mu g/m^3$)	
	1977	1981
Allen	360	149
Bull Run	153	99
Colbert	187	125
Cumberland	184	91
Gallatin	222	93
John Sevier	103	108
Johnsonville	510	384
Kingston	173	101
Paradise	598	125
Shawnee	186	100
Watts Bar	90	89
Widows Creek	266	196

Table 9

Calculated National Air Pollution Emissions

1980

Source	Air Pollution Emissions (10^6 tons/year) Particulates	SO_2	NO_x
Utilities	1	18	7
Industrial	4	7	4
Transportation	2	1	10
Other	2	-	2
TOTAL	9	26	23

COST OF COMPLIANCE WITH AIR QUALITY CONSENT DECREE REQUIREMENTS TVA COAL-FIRED GENERATING PLANTS

Discussion

In August 1981, the capital cost for implementing the compliance program covered by the consent decree was estimated to be $724 million. We also estimated that by 1983, when the program was scheduled to be completed, annual costs would be $334 million in 1982 dollars.

In the two years since this estimate was made, a number of changes have occurred which have increased the capital cost estimate to $927 million, or an increase of $203 million above the 1981 estimate. A plant-by-plant summary of the costs is given in the attached table 1. The major reasons for this increase are as follows:

1. In FY 1982, TVA's accounting practices were modified for capitalizing an allowance for funds used during construction for projects of this type. This change resulted in an increase of $73 million in the capital cost of projects which were not completed before FY 1982. Over half of these charges ($46 million) are against the Paradise scrubber project.

2. Our 1981 estimates only included costs for temporary refuse and sludge disposal facilities at Widows Creek. Since that time, more permanent disposal arrangements have been designed or are being installed. Sludge disposal provisions at this plant have resulted in an increase of $22 million.

3. In addition to the cost increases identified in items (1) and (2) above, the major differences in capital costs for these projects are as follows:

    a. Paradise Scrubbers--The inability of Envirotech Corporation to fulfill the terms of its contract resulted in a takeover of the project by TVA. This change in project management caused a major disruption which increased the time required to complete the project, thus resulting in an increase of costs. Also this project had several scope additions, such as ballmill and maintenance building, handling and maintenance equipment, and transformer rectifier. The total cost increase, including associated overheads, is about $47 million.

    b. Cumberland Precipitators--The cost of additional construction work which required gas duct system, erection of precipitators, and reinforcement of stack breaching and associated overheads is estimated to be $9 million. The extended construction schedule, fire protection, health and safety items, and work requiring a plant outage resulted in an additional increase of $3 million.

c. Shawnee Baghouses--The baghouse has to be rebagged and respringed due to unacceptable material used for the original bags. The total cost for this and additional scope of reversed air modulating and cleaning the system is $9 million.

d. Paradise Coal Washing--The cost increase for this project is for several scope additions. These additions are constructing a coal fines refuse disposal area, enlarging the reclaimed hopper, and relocating county roads and coal yard handling facilities. The cost for this increase and associated overheads is about $27 million.

e. Paradise Precipitators--Precipitator transformer rectifier (TR) sets were not operating properly which resulted in an operational failure. The TR set failures present safety and fire hazards, and the sets are unreliable during operation. Their replacement cost is approximately $5 million. Scope additions for hopper heaters, railroad modifications, and extended construction schedule resulted in an increase of $3 million with a total project cost increase of $8 million.

f. Widows Creek Scrubbers, Unit 7--The increased scope of work in the scrubber contract, additional cost for steam piping, framing modifications, and hoisting equipment, along with associated overheads, resulted in an increase of $8 million.

g. Gallatin Precipitators--Additional scope for hopper heaters and extended construction schedule resulted in an increase of $6 million.

As indicated in table 1, some of the above cost increases were offset by a combined saving of $9 million on Cumberland coal washing and Johnsonville stacks and precipitator upgrade projects.

The attached table 2 shows updated estimates of the annual cost associated with the consent decree compliance program, including amortization of investment, premium for low-sulfur coal, coal-washing costs, and operating and maintenance costs for pollution control equipment. In 1981 we had estimated our annual costs would be $334 million (1982 dollars) upon completion of the program. We now estimate these annual costs at $346 million (1984 dollars). The increases in annual costs resulting from higher capital costs and two additional years of inflation are partially offset by cost reductions due to lower coal-fired generation on the system.

The revised FY 1984 annual operating and maintenance cost and coal premium estimates are based on FY 1984 plant operating levels projected by the Division of Power System Operations during April 1983. At these operating levels, the power system is projected to burn about 29 million tons of coal. The earlier cost estimate for FY 1983 operation was based on an annual coal burn rate of approximately 33 million tons. Thus, should the total coal burn for FY 1984 be higher or lower, the actual costs could vary from this value using a nominal coal burn. Other assumptions for operating and maintenance costs are (including unit coal premiums) similar to those which formed the basis for our earlier estimates of the annual costs of compliance.

For your information, we have also updated the total capital cost estimates of TVA's total air compliance program. With capitalized interest during construction included for FY 1982 and later, the total capital cost estimate will be $1.285 billion. This program includes the consent decree projects, the projects implemented prior to the consent decree, and one project (the Colbert Steam Plant stack) which was implemented after the consent decree.

The attached table 3 shows that, by 1984, TVA will have invested approximately $1.3 billion in air pollution control equipment at its 12 coal-fired plants. The annual cost of amortizing this investment and of operating and maintaining the equipment will be about $225 million for FY 1984. In addition, TVA must pay a premium price for the lower sulfur coal being burned at its plants. It is estimated that this premium adds about $164 million (1984 dollars) for FY 1984 to the cost of coal being burned at these plants. This includes the cost of washing the coal burned at Paradise and Cumberland. Thus, the total annual cost of air pollution control at TVA's plants is estimated to be about $389 million (1984 dollars) as shown in table 4 (attached). The premium price for the low-sulfur coal being burned and estimated operating and maintenance costs would vary, depending upon the operating levels of coal-fired plants. For example, a 10-percent increase in coal burn rate would raise the total FY 1984 annual coal premium cost by about $20 million (1984 dollars).

The revised estimates do not indicate any change from earlier estimates of increased revenue requirements because of the air quality compliance program. In FY 1984, when TVA's pollution control program will be completed, these costs would result in an increase of about 9.7 percent in TVA's total revenue requirements. However, as indicated above, in subsequent years this percentage will vary, depending upon the use of TVA's coal-fired generating system and supply of load demand from nuclear plants.

Table 1

AIR QUALITY COMPLIANCE PROGRAM - CAPITAL COSTS
CONSENT DECREE PROJECTS ONLY
(MILLIONS OF DOLLARS)

Plant	Type of Equipment	August 1981 Estimates	November 1983 Estimates
	Sulfur Dioxide		
Cumberland	Coal washing	$ 53	$ 52
Johnsonville	Stacks and precipitators upgrade	69	67
Paradise	Coal washing	115	145
	Scrubbers units 1 and 2	151[a]	244[a]
Shawnee	Baghouses	76	85
Widows Creek	Scrubbers unit 7	48	56
	Sludge disposal	-	25
Total (SO_2 only)		512	674
	Particulates		
Cumberland	Precipitators	120[a]	144[a]
	Provision for scrubbers	19	19
Gallatin	Precipitators	43	52
Paradise	Precipitators unit 3	30	38
Total (particulates only)		212	253
Grand Total		$724	$927

[a] Does not include the cost of balanced draft conversion.

Table 2

AIR QUALITY COMPLIANCE PROGRAM - ESTIMATED ANNUAL COSTS CONSENT DECREE PROJECTS ONLY (MILLIONS OF DOLLARS)

Plant	Compliance Method	August 1981 Estimates For FY 1983[a]	November 1983 Estimates For FY 1984[b]
	Sulfur Dioxide		
Allen	Medium-sulfur coal	$ 5	$ 4
Colbert	Medium-sulfur coal	8	6
Cumberland	Coal washing	30	34
Gallatin	Medium-sulfur coal	16	18
Johnsonville	Lower sulfur coal and precipitator upgrade	50	33
Kingston	Low-sulfur coal	12	18
Paradise	Coal washing and scrubber units 1 and 2	83	97
Shawnee	Low-sulfur coal	43	41
	Baghouses	13	14
Watts Bar	Medium-sulfur coal	2	-
Widows Creek	Low-sulfur coal (units 1-6); scrubbers and medium-sulfur coal (units 7 and 8)	42	46
Total (SO_2 only)		$304	$311
	Particulates		
Cumberland	Electrostatic precipitators	$ 19	$ 22
Gallatin	Electrostatic precipitators	7	7
Paradise unit 3	Electrostatic precipitators	4	6
Total (particulates only)		$ 30	$ 35
Grand Total		$334	$346

a. 1982 dollars based on 33 million tons of coal burned.
b. 1984 dollars based on 29 million tons of coal burned.

Table 3

AIR POLLUTION CONTROL PROGRAM - CAPITAL COSTS
TVA COAL-FIRED PLANTS
(Millions of Dollars)

Plant	Type of Equipment	August 1981 Estimates	November 198 Estimates
Allen	Precipitators	$ 10	$ 10
Bull Run	Precipitators	33	33
Colbert	Precipitators	22	22
	Stacks and duct	15	15
	Total Colbert	37	37
Cumberland	Coal-washing facility	53	52
	Stacks and precipitators	133[a]	157[a]
	Scrubbers (cancelled)	19	19
	Total Cumberland	205	228
Gallatin	Precipitators	49	58
John Sevier	Precipitators	12	12
Johnsonville	Precipitators	27	27
	Stacks and precipitators upgrade	69	67
	Total Johnsonville	96	94
Kingston	Precipitators and stacks	71	71
Paradise	Coal-washing facility	115	145
	Scrubbers units 1 and 2	151[a]	244[a]
	Precipitators	37	45
	Total Paradise	303	434
Shawnee	Precipitators	9	9
	Baghouses	76	85
	Tall stacks	26	26
	Total Shawnee	111	120
Watts Bar	Precipitators	2	2
Widows Creek	Precipitators and stacks	55	55
	Scrubbers	98	106
	Sludge disposal	-	25
	Total Widows Creek	153	186
Grand Total		$1,082	$1,285

[a] Does not include the cost of balanced draft conversion.

Table 4

AIR POLLUTION CONTROL PROGRAM - ESTIMATED ANNUAL COSTS
TVA COAL-FIRED PLANTS
(Millions of Dollars)

Plant	Compliance Method	August 1981 Estimates For FY 1983[a]	November 1983 Estimates For FY 1984
Allen	Precipitators, medium-sulfur coal	$ 6	$ 6
Bull Run	Precipitators, medium-sulfur coal	4	5
Colbert	Precipitators, stacks and duct, medium-sulfur coal	14	11
Cumberland	Coal washing, precipitators	50	57
Gallatin	Precipitators, medium-sulfur coal	24	27
John Sevier	Precipitators, medium-sulfur coal	2	2
Johnsonville	Precipitators, stacks, lower sulfur coal	54	37
Kingston	Precipitators, stacks, low-sulfur coal	22	28
Paradise	Coal washing, scrubbers units 1 and 2, precipitators unit 3	88	103
Shawnee	Precipitators, baghouses, tall stacks, low-sulfur coal	61	60
Watts Bar	Precipitators, medium-sulfur coal	2	-
Widows Creek	Precipitators, stacks, low-sulfur coal (units 1-6); scrubbers and medium-sulfur coal (units 7 and 8)	49	53
Total		$376	$389

a. 1982 dollars based on 33 million tons of coal burned.
b. 1984 dollars based on 29 million tons of coal burned.

APPENDIX C

ASSUMPTIONS USED IN DEVELOPING COSTS OF ACID RAIN CONTROL BASED ON TOTAL SO_2 EMISSIONS

1. Utilities will be required to take all the SO_2 reductions for the State.

2. Each utility's share of the SO_2 reductions would be proportioned based on the total utility SO_2 emissions in the State.

3. TVA-required reductions in Tennessee, Alabama, and Kentucky can be taken anywhere on the system regardless of State lines.

4. Compliance will begin in 1995.

5. Each power plant has an economic writeoff period of 50 years. Limestone scrubber retrofits will be written off over the remaining economic writeoff period of each plant. A discount rate of 15 percent is used.

6. Limestone scrubber retrofits are evaluated at a capital cost of $200/kW in 1983 dollars, including interest during construction. A SO_2 removal efficiency of 85 percent is used. No major changes in scrubber costs are considered which could result from a major increase in demand.

7. The assumed price of low-sulfur coal does not include potential additional premiums due to a major increase in demand.

8. Compliance is met by a combination of least emissions dispatching, fuel switching, and limestone scrubbing.

9. No offsets or costs for additional controls for new sources are included.

10. Nuclear generation for each year will not drop below a level corresponding to an overall nuclear capacity factor of 60 percent. Normal hydro generation is assumed for each year.

11. No major unplanned outages at coal-fired plants where limestone scrubbers or lower sulfur coal is used are considered.

12. No transmission constraints which would prohibit or limit least emissions dispatching are included.

13. The minimum impact case is based on low load growth with a high level of conservation (20.9 billion kWh savings in FY 2000).

14. The major impact case is based on no additional nuclear capacity beyond Hartsville unit A 2. The minimum impact case is based on no additional nuclear capacity beyond Bellefonte unit 2.

15. Minimum cost case includes the cost incurred to protect against actual loads being higher than projected minimum.

16. Plants with limestone scrubbers for the maximum and minimum impacts are:

Reduction Goal	Maximum Impact	Minimum Impact
8 million tons	Cumberland (partial scrubbing)	---
10 million tons	Cumberland	---
12 million tons	Cumberland, Paradise unit 3, Gallatin (partial scrubbing)	Cumberland (partial scrubbing)

ATTACHMENT-1

Cost to TVA of Various SO_2 Reductions if Allocation is Based on Total SO_2 Emissions in Each State[a,b]

National Reduction	Maximum Impact[c]			Minimum Impact[c]		
	Reduction in SO_2 Emissions from present stds	Capital Investment	Annual Cost	Reduction in SO_2 Emissions from present stds	Capital Investment	Annual Cost
	(1,000's tons)	($millions)	($millions)	(1,000's tons)	($millions)	($millio
8 million tons	371	100	150	11	0	0
10 million tons	535	520	240	175	0	90
12 million tons	699	875	340	339	300	160

a. All costs in 1983 dollars.

b. Potential Rate Impacts on TVA System - TVA has the potential to achieve significant SO_2 reductions at relatively low cost by replacing coal-fired generation with generation from four nuclear units presently under construction. With projected load forecasts and the nuclear and coal-fired generation available to meet these projected needs, the expected rate impacts in 1995 would be as follows:

8 million ton reduction	0 to 2.6%
10 million ton reduction	2.5 to 4.2%
12 million ton reduction	4.5 to 6.0%

c. TVA's 1980 SO_2 emissions totaled 1.586 million tons compared to a peak emission level of 2.381 million tons in 1976. Under the maximum impact (high load growth scenario) SO_2 emissions would total 1.30 million tons in 1995 with present emission standards. Under the minimum impact (loads remain essentially unchanged from their present levels) in 1995, SO_2 emissions would total 0.94 million tons with present emissions standards.

8/9/83:E&PSS

ASSESSMENT OF ENVIRONMENTAL EFFECTS OF ACIDIC DEPOSITION

Executive Summary

Many scientists, including those of the Tennessee Valley Authority, now recognize as a working hypothesis that acidic deposition can contribute to long-term damage to sensitive ecosystems. It is evident that scientifically assessing acidic deposition impacts is much more complex than it first appeared, and establishing unique cause-and-effect relationships may not be possible. It is extremely difficult to isolate the effects of acidic deposition from those of other factors. However, from the perspective of a TVA assessment of presently available knowledge, acidic deposition is likely one factor but not the only factor involved in effects on forests, waters, and fish. There is little direct evidence of environmental impact of acidic deposition, and TVA has no direct evidence of a link between acidic deposition and impacts on the resources in the Tennessee Valley. In spite of this lack of direct evidence, the probability of cumulative impacts from at least partial involvement in some of the many types of damage implicated by circumstantial evidence leads to the conclusion that acidic deposition must be considered a significant threat to the environment.

Many direct contact and indirect effects of acidic precipitation on forest productivity have been postulated based on fundamental responses of biological systems to acidity and other stresses. Growth patterns of mature forests in parts of Europe and North America, including the mountains of eastern Tennessee, have been altered in recent decades. Potential direct effects of acidic precipitation include those associated with seedling establishment and early growth, thinning of protective leaf coatings, changes in chlorophyll content, and interference with pollen development or seed germination. Acidic deposition may also be involved in decreasing the availability of nutrients to trees and increasing the availability of toxic metals from the soil. Acidic deposition may be involved in complex, synergistic interactions with primary gaseous pollutants, airborne toxic metals, climatic factors, and other site-specific variables that may affect tree growth or weaken trees and lead to secondary damage by insects or diseases. Changes in forest growth could be purely circumstantial and not related to acidic deposition, but it is much more likely that there has not yet been adequate linking of the very complex association of multiple and interactive factors involved and the subtle and chronic responses.

Direct damage to the foliage of some agricultural crops has been observed as a result of highly acidic simulated precipitation, but these direct effects have not been documented in the field. Available experimental data are not adequate to define the effects of acidic deposition; however, research indicates that any potential effects on soil acidity or soil nutrients are likely to be insignificant compared to the effects of agricultural practices such as nitrogen fertilization.

Available studies indicate that acidic deposition affects water quality in the same complex manner as it affects other areas of the environment--as a contributing factor, not the single cause. Data suggest that some high-elevation streams and lakes in Canada and the northeastern United States are becoming increasingly acidic. Studies indicate somewhat less clearly a trend of increasing acidity and decreasing alkalinity in portions of the Southern Blue Ridge Province in the Tennessee Valley. Short-term acidification of surface waters in North Carolina from runoff of heavy rains has been documented by TVA studies. The data from these studies did not rule out acidic deposition as a contributing factor; however, they provided strong evidence that the most significant short-term contributor is the soil of the forested watershed. Acidification of lakes and reservoirs has been circumstantially attributed to acidic deposition of air pollutants from distant sources, but the relative importance of nearby sources and natural terrestrial and aquatic processes is not known. People who drink acidic water, whatever the source of acidity, are considered at risk of increased intake of lead and possibly cadmium and aluminum that may contaminate the source or that may be dissolved from components of the distribution system.

Of all the potential effects of acidic deposition perhaps none is of greater emotional or scientific concern than the suspected role in the decline of fish populations; however, because of the complex interacting processes, there is perhaps greater uncertainty about effects on fish than on any other component of the ecosystem. Acidity alone or in combination with other factors can cause lethal or sublethal effects on adult fish and may reduce reproductive and developmental success. Some lakes are already too acidic to support fish, and some lakes are considered to have lost fish as a result of recent increases in acidity. Many lakes are considered susceptible to increased acidification and loss of fish, including some in the Southern Blue Ridge Province. Concern about these Valley fisheries is related to observed spinal deformities in smallmouth bass, trout mortalities in aquaculture facilities, decline in the range of brook trout, and possible aggravation of existing water quality effects on fisheries.

ASSESSMENT OF ENVIRONMENTAL EFFECTS OF ACIDIC DEPOSITION

Introduction

This document assesses potential environmental effects of acidic deposition. The perspective section places the implications of environmental damage by acidic deposition within the context of other complex physical and chemical processes that may affect soils, waters, forests, fisheries, water supplies, and agricultural crops. From the perspective of TVA's assessment of presently available knowledge, acidic deposition is very likely a contributing factor but not the only factor involved. This is especially significant because there is little direct evidence of acidic deposition effects and because TVA has no direct evidence of a link between acidic deposition and effects upon resources in the Tennessee Valley.

The document includes sections that discuss environmental effects on forests, crops, water quality, and fisheries and the processes by which these effects may occur. The purpose of these sections is not to provide an exhaustive listing of all reported effects but to provide discussion of the results of some selected investigations and studies that TVA believes to be professionally and scientifically credible and a general summary of the overall implications of these studies.

The document does not assess the significance of acidic deposition relative to other causitive factors or weigh the benefits of controls or environmental risks encountered because of the delay or lack of controls. However, such risks are clearly implied.

Perspective

More than a century ago, a British chemist noted damage to plants and materials, attributed it to "sulfur acid" in the air, and coined the term acid rain. A quarter century ago, Scandinavian scientists investigating declining yields from forests and lakes noted an apparent increase in the acidity of rainfall and surface waters. They postulated that urban and industrial pollutants were directly responsible for increasing the acidity of precipitation, which in turn was directly altering conditions in the terrestrial and aquatic environments and reducing biological productivity. About a decade ago, many scientists independently attempting to account for a wide range of environmental changes in widely scattered parts of the world noted similar empirical support and preliminary experimental evidence for this postulate.

Most scientists carefully qualified their findings as tentative and based on incomplete information. However, worldwide attention was focused on the potential for ecological disaster, and the reservations and caveats were ignored. Preliminary conjecture was accepted as fact in some cases, and acid rain became an emotional as well as a scientific issue.

Subsequently, during the period of critical review that is an integral part of the scientific process, new studies challenged the validity of many earlier studies. Scientists pointed out that new measurements had been compared with scattered historical data that were in many cases not directly comparable because they involved significant differences in factors such as analytical techniques, climate, meteorology, season of the year, time of day, bedrock geology, soil type and depth, vegetative cover, and land use. Measured levels of acid rain were calculated to be insufficient to account for some of the environmental changes attributed to them. Inconsistencies were noted--studies of sediment samples and other evidence showed that some of the lakes in question had become acidic hundreds or even thousands of years before the increase in combustion of fossil fuels, and some lakes became acid while closely neighboring lakes exposed to identical precipitation under apparently similar conditions remained unchanged. Estimates of the extent and severity of environmental change were reassessed, and the term acid rain became acidic deposition in recognition of the complexities of the issue.

Critical review revealed that the issue is more complex than it first appeared, indicated that atmospheric deposition is one likely factor but not necessarily the only factor that must be considered, and mapped the course for experimental investigation. As a result, hundreds of new research projects have been undertaken in many parts of the world to examine in greater detail the environmental processes that are involved.

Each type of investigation is subject to inherent limitations. Field observations of conditions at a site before and after acidification is suspected to have occurred are complicated because historical data are sparse and of questionable validity, because measurement techniques have changed and do not produce directly comparable results, and because changes in land use and other factors during the course of the acidification process make it difficult to isolate the effects of acidic deposition from those of other variables. In contemporary comparisons of similar environments thought to exhibit different degrees of acidic effects, it is also difficult to separate the effects of acidic deposition from the effects of the various factors that may be involved but that cannot be controlled. Field experiments focused on modifying one variable may overlook effects caused by the interaction of several other variables that cannot be controlled. For practical reasons, such field experiments are limited to a few months or a few years, while regional acidification occurs over many years or decades, and the compression of the time scale may produce misleading results. Controlled experiments that rely upon simulated acidic precipitation applied at a greatly increased rate or at a greatly increased concentration are subject to similar questions. Laboratory experiments that carefully control all variables other than the one being evaluated may miss the effects of interaction among several variables and may be limited by the effects of the artificial habitat and the elimination of natural competition and interaction among various species.

Results obtained from one type of experiment at one site or in one region under one set of conditions for one species cannot be extrapolated to a general conclusion regarding the entire question of acidic deposition effects. Each conclusion from each study becomes the subject for a new cycle of critical review and further experiments to resolve uncertainties.

Those who are responsible for making decisions regarding a suspected danger to the public welfare desire clear and certain proof of the nature and extent of that danger. Science seldom provides the luxury of such absolutes. Instead, it provides circumstantial evidence that must be weighed and balanced to indicate probability.

Intensive investigation has not substantiated the existence of a single, unbroken chain of cause and effect. However, it has traced here and there in the complex web of the environment what is believed to be a common factor. Most leading scientists, including those in the Tennessee Valley Authority, now recognize as a working hypothesis that acidic deposition under certain conditions can directly and indirectly contribute to certain types of long-term damage to sensitive ecosystems in many regions of the world, including portions of the Tennessee Valley.

There is a considerable weight of circumstantial evidence that implicates acidic deposition as one of the contributing factors in a long list of effects on soils, vegetation, surface waters, aquatic organisms, and drinking water. In almost every instance, there is also circumstantial evidence implicating other processes and pollutants, some natural and some related to human activities. Not all the suspected effects have been observed in all apparently similarly suspectible environments that have been studied, and significant differences between the results of apparently similar investigations of the same suspected effects have not yet been resolved. It may be a long time before research pinpoints the relative significance of the multiple factors that may be involved in each type of damage. However, these uncertainties and the need for continuing research do not negate the present significance of acidic deposition as one common factor that appears to be involved in varying degrees in many different environmental impacts. The probability of cumulative impacts from at least partial involvement in some of the many types of damage now suspected leads to the conclusion that acidic deposition must be considered a significant threat to the environment.

Forests

Many direct and indirect effects of acidic precipitation on forest productivity have been postulated based on fundamental responses of biological systems to acidity and other stresses.

Based on experimental evidence with simulated precipitation, a wide range of plant species is believed to be sensitive to direct contact injury, while other species have been noted to be tolerant of equally elevated levels of acidic precipitation. Research conducted by TVA has detected no direct effects of acidic precipitation on seedlings of three important forest species in the Tennessee Valley. Factors evaluated included morphological factors such as changes in thickness of the wax covering of leaves and physiological responses such as changes in chlorophyll content or respiration. TVA data as well as the data of others suggest that generalizations about sensitivity to direct injury may be quite difficult, because most work indicates response to be species specific. Another area of potential direct injury is pollen development, seed germination, and seedling establishment. Evidence to date indicates that the seedling establishment stage may be the most sensitive to direct effects of acidic precipitation, followed by the early seedling growth stage for some species. While neither of these potential effects would be important in causing short-term effects on productivity, both would be significant in the long run, in terms of maintaining the present mix of tree species in the forest and maintaining long-term productivity.

Various studies have presented data indicating that species composition or population densities of insect groups are altered in areas of high air pollution stress. However, little information is available on the direct effects of acidic precipitation on either harmful or beneficial insects. Research on the response of plant diseases has indicated that a given dose of a specific air pollutant may be stimulatory, neutral, or detrimental to the growth of a particular virus, bacterium, or fungus. The most likely effect is an indirect or secondary effect; if trees are weakened by acidic deposition, alone or in combination with other factors, they may be more susceptible to invasion by insects or disease.

Because the level of productivity achieved by a particular forest is a result of the interaction of a number of factors, barring the impact of a significant direct contact effect, it is much more likely that any change in productivity will be the result of the additive indirect effects of several factors. Two such factors identified as having a high probability of impact are (1) decreases in the availability of essential nutrients or increases in the availability of toxic metals and (2) interactive effects of acidic deposition with gaseous pollutants or interactions of gaseous pollutants with changes in nutrient availability. Most research to date suggests that possible changes in productivity are associated with chronic exposures or changes. As is true of most chronic environmental problems, it is difficult to isolate a single factor as being responsible for the change. This problem is made even more difficult by the fact that some of the precursors of acidic deposition (sulfur dioxide and nitrogen oxides) are also toxic to plants in the gaseous form in which they are emitted as primary pollutants. The possibility of synergistic interactions of pollutants is also a real possibility, adding further complexity to the question.

To date, the greatest research emphasis in assessing potential changes in forest productivity has been directed toward nutritional effects.

Acidic deposition can both add essential plant nutrients to the soil and remove others from it. Another aspect of the question is the potential for increased acidification of forest soils and the subsequent changes in soil chemistry, especially increased availability of aluminum and other metals that are toxic to plants. TVA research has indicated that changes in soil nutrient status do appear to occur in conjunction with simulated acidic deposition treatments, with certain elements such as calcium being redistributed within the soil profile. However, the same study detected no effects on the growth of tree species that were evaluated. Studies have shown that some soils in Tennessee are no longer able to absorb additional sulfur; essential nutrient anions such as calcium may combine with unabsorbed sulfate cations and be lost from the soil. Field studies have yet to link observed or suspected changes in fertility to suspected or anticipated changes in productivity; the suspicion continues, but the means of verification have not been developed. Ulrich has recently documented increases in concentrations of aluminum in the soil and the soil solution at forest sites in West Germany. These changes are of significance to forest productivity because plant roots are sensitive to elevated levels of aluminum, and several tree species have suffered either death or decline in growth in that area.

Although considerable weight is still given to changes in fertility and effects of aluminum as potential causes of reduced productivity, more recent hypotheses include interactions of acid deposition with other pollutants such as ozone, sulfur dioxide, and nitrogen oxides. Studies in the Great Smoky Mountains of east Tennessee have indicated that productivity of red spruce, shortleaf pine, hemlock, hickory, yellow birch, pitch pine, and Fraser Fir is declining. The researchers noted that these declines, together with those in New England, suggest decreased productivity has been occurring over the past two decades. A combination of pollutants, including acidic deposition, ozone, and trace metals, was proposed as a possible cause. The impact of cloud contact with trees in high elevation forests has been identified as a potential factor in the declining productivity indicated by these studies. Studies conducted at a site in the Great Smoky Mountains National Park indicated that the concentration of iron in tree rings was elevated during the period 1863 to 1912 and that the trees showed a simultaneous decline in growth. A smelter approximately 90 kilometers upwind began operations in 1854 and, by court order, reduced emissions in 1910. This is further indication that emissions of acid precursors and airborne trace metals may affect metal uptake and the growth of trees.

Early studies by TVA in the vicinity of one of its coal-fired power plants indicated that white pine productivity was reduced near the plant; rather than a single pollutant, a mixture of pollutants is suspected as the causal agent. Based largely on information gathered in Europe and the northeastern United States, it is now widely thought that forest decline is the result of possible synergistic interactions among gaseous pollutants, acidic deposition, metal toxicity, and excessive loss of nutrients such as magnesium and calcium. While there does not appear to be a strong relationship with changes in the amount of precipitation (drought), interactions with other climatic variables cannot be ruled out at this time.

In summary, research to date indicates that direct contact effects attributable to acidic deposition are limited. The most serious potential effects are associated with seedling establishment and early seedling growth. The net effect of acidic precipitation on soil fertility depends on a number of site-specific factors. Acidic deposition in sufficient amounts will likely reduce productivity on sites where levels of nitrogen and sulfur are adequate but where levels of other nutrients are deficient. TVA experience documents, as does the work of others, the potential for changes in productivity. These changes have been demonstrated only in controlled studies, not in the field.

There is no direct proof that acidic deposition is now limiting growth of forests. Field studies of mature forests show that growth patterns have been altered in recent decades in many North American and European forests. Declines in productivity of several species of trees in the higher elevations of eastern Tennessee have been documented. Although to date no clear link has been established between these changes in forest growth and acidic deposition, such a relationship has not been disproved. Recent changes could be purely circumstantial and not in any way related to acidic deposition, but it is much more likely that there has not yet been adequate linking of the very complex association of multiple and interactive factors involved and the subtle and chronic responses.

Crops

Acidic deposition may affect crop productivity by two routes: (1) Indirectly, through effects on the soil, soil microorganisms beneficial to crop productivity, and plant pests; and (2) directly, through contact with the plant foliage or other plant surfaces.

Acidic deposition may affect crop productivity by accelerating: (1) acidification of soils to levels that are unsuitable for production of plants that require neutral or nearly neutral soils or (2) leaching of plant nutrients such as calcium and magnesium. However, there appears to be consensus among plant scientists that these effects of acidic deposition on agricultural soils are insignificant compared with those caused by cultural practices such as nitrogen fertilization.

Investigations of the effects of simulated acidic deposition on various plant pests, including insects and diseases, have shown both increases and decreases in pests. There is little information on the effects of acidic deposition on soil microorganisms beneficial to crop plants. However, it has been reported that simulated deposition, at levels 10 times more acidic than average levels now occurring in precipitation over large areas of the northeastern and southeastern United States, reduced populations of beneficial nitrogen-fixing bacteria in some legumes.

Acidic deposition directly on the foliage and other surfaces of crop plants may adversely affect production through effects on photosynthesis, flowering, fruit set, and seed germination and possibly through other metabolic processes or through acceleration of leaching of nutrients from the foliage. However, no effects of acidic deposition have been documented under field conditions. There have been many investigations of the effects of simulated acidic deposition on crop and garden species under field and controlled environmental conditions. Results have been inconclusive, even for the same species or cultivar. In a few studies, yields of some crop species showed negative responses to acidic deposition; however, most studies indicate no effect on productivity from highly acidic simulated precipitation. Garden beets and carrots showed the most consistent reductions in yields at several levels of simulated acidity. Yields of "Pioneer 3992 field corn" and "Amboy" soybean decreased in response to some acidity levels and increased in response to others. In a large number of experiments, alfalfa, fescue, mustard greens, tomatoes, and wheat, and many other species produced increased yields, perhaps in response to a fertilizing effect of the nitrate and sulfate in the simulated rain.

Available experimental data are not adequate to define the effects of acidic deposition. Cultivars within a species can show a wide range of responses to a stress. Net response to stress is determined by the interactions of a multiplicity of cultural, soil, and climatic factors that have not been investigated with respect to acidic deposition.

In summary, direct damage to some agricultural crops has been observed at low pH under laboratory conditions, but available laboratory and field data are not adequate to define effects of acid deposition. Results tend to indicate that the effects of accepted agricultural practice outweigh potential impacts of acidic deposition.

Water Quality

Atmospheric deposition has been shown to increase the concentration of hydrogen ions and other substances in surface waters near point sources of air pollutants. One of the most cited examples of this phenomenon occurred in the Tennessee Valley at Copperhill, Tennessee, where emissions from a copper smelter resulted in acidification of surrounding soils and surface waters. Similar effects have been observed from smelter emissions near Sudbury, Ontario, where increased levels of acidity, sulfate, copper, and nickel have been reported in lakes in the area.

A large body of circumstantial evidence has also been compiled to suggest that long-range transport of acids has caused acidification of freshwaters in North America. For the most part, only extrapolations of these data have been made to the southeastern United States. Most of the studies were performed in Scandanavia, Canada, and the northeastern United States.

The effect of acidic deposition on the water quality of streams and lakes depends not only on what is deposited, but also on its interaction with all components of the terrestrial system that it contacts before it is discharged into the aquatic system. The effect of the terrestrial system is probably greatest for lake systems with relatively large watershed areas and relatively small lake areas, where most of the precipitation comes into contact with the terrestrial system before reaching the lake. The effect of acidic deposition is potentially greatest for lakes with no defined inlet and with relatively large areas of lake surface and relatively small watershed areas--where more of the precipitation falls directly on the lake without ever coming into contact with the terrestrial system. The direct effect of acidic precipitation on such lakes is now being investigated in the Adirondack region of New York and in upper midwestern States.

Snowmelt has been implicated in causing direct effects on aquatic systems. In two Adirondack lakes, alkalinity decreased during snowmelt because of dilution of base cations and an increase in nitric acid in the lake. Researchers concluded that the primary cause of the increased concentration of nitrates was release of accumulated nitrates from the snowpack. An analysis of two additional snowmelt incidents supported this conclusion.

Short-term acidification of surface waters from runoff of heavy rains has been documented. A TVA study in the Raven Fork watershed near Cherokee, North Carolina, concluded that increased stream acidity following heavy rainfall, possibly in combination with resulting increases in aluminum concentrations, contributed to fishkills. However, the data provided strong evidence (1) that the forest soil in the watershed area is strongly buffered by weak organic acids against changes in hydrogen ion concentration from addition of hydrogen ions from external sources such as the strong acids in atmospheric deposition, and (2) that the forest soil controls hydrogen ions and aluminum concentrations in the creek water following storms. These results may not be applicable to other watersheds. The Raven Fork watershed is a mature, coniferous forest with acidophilic species such as rhododendron that cycle large amounts of aluminum, and the highly acidic soils (pH 3.7 to 4.1) are high in exchangeable hydrogen, organic matter, and aluminum. The data did not rule out the possibility of acid deposition as a contributing factor.

The long-term relative effects of acidic deposition on freshwaters is more difficult to assess. Some data support the hypothesis that internal generation of hydrogen ions in watersheds can be greater than inputs of hydrogen ions from the atmosphere. Factors commonly considered to make watersheds susceptible to acid deposition are the same factors long known to acidify soils through natural processes. Therefore, some researchers believe that natural soil formation is often more important than acid deposition in determining the acidity of lakes and streams. Other researchers indicate that atmospheric sources of acids can amount to 50 percent of that generated internally.

It is well known that lake ecosystem processes are very important in influencing the generation or consumption of akalinity and internal production of alkalinity in the epilimnion of a lake. Internal processes in the hypolimnion are capable of either depleting or increasing alkalinity. Processes that occur in lake sediments may also affect the acid-neutralizing capacity of lake water, although these processes are not well documented.

Identification of areas with aquatic systems potentially sensitive to acidic deposition has been approached using several related methods that may be classified into three general categories--those using soil characteristics, bedrock geology, and actual values of surface water alkalinity. Sensitive areas in North America have been roughly approximated on the basis of bedrock geology. Large areas of eastern Canada were considered sensitive, as were the Northeast, the upper Midwest, the Pacific Northwest and the Rockies, and the southern Appalachians. Soil characteristics were also used to locate regions in the eastern United States potentially sensitive to acidic deposition with somewhat similar results. Surface water alkalinity data have been correlated with physiography, geology, soils, climate, and human factors to predict mean annual alkalinities for all regions of the United States, even those without alkalinity data. This method, in effect, combines several other important factors and, like the other techniques, suggests that the Southern Blue Ridge Province in the Tennessee Valley contains sensitive aquatic systems. It has been shown, however, that several other factors may influence sensitivity to acidification, including topography, the ratio between lake area and watershed area, watershed vegetation, land use, surface water quality, and aquatic vegetation. The relative importance of each characteristic depends on site-specific conditions.

Numerous investigators have evaluated available surface water quality data in areas receiving acidic deposition. In some areas of the northeastern United States and eastern Canada, a large number of lakes have reportedly experienced increasing acidity as a result of acidic deposition. TVA recently completed a preliminary study of the trends in pH and alkalinity of surface waters in the Southern Blue Ridge Province. A decline averaging 0.02 pH unit per year was observed for high-elevation, low-alkalinity streams for which sufficient data were available. Acidic deposition is a potential contributor to the observed changes in water quality. Higher rainfalls in recent years may also have played a significant role in observed trends. These data are now being investigated in more detail.

A consistent drawback of these types of studies is the lack of documentation available for the "historic" data due to errors associated with a comparison of old and new data. This often precludes making an absolute statement that individual systems have become more acidic. One recent study, however, reviewed water quality records over a 10- to 15-year period where consistent sampling and analytical methods were applied. The results provide evidence that observed patterns in water quality trends reflect regional changes in the rates of sulfur dioxide emissions. The body of knowledge does provide circumstantial evidence for recent acidification in the northeastern United States and Canada. Supporting this circumstantial evidence is the analysis of diatoms in lake sediment cores. These paleolimnological techniques have been applied in Norway with apparent success in providing indications of acidification trends. Researchers are now investigating the same techniques in the northeastern United States and the Southern Blue Ridge Province.

Health risk in drinking water supplies is related to the source of the water and the treatment and distribution of the supply. Data on impacts of acidic deposition on water supplies are extremely scarce. Available studies are based on data from impacts to aquatic ecosystems. Two main drinking water impacts may exist--contamination of water at the source or increased corrosivity that in turn may cause dissolution of lead or cadmium. A frequently cited example of the latter is the case of Boston, Massachusetts. The high acidity of the drinking water supply, whatever the cause, contributed to lead poisoning of children where lead water distribution pipes were in use. People who obtain drinking water from roof catchment cisterns have potential risk of increased intake of lead in areas receiving acidic deposition, regardless of terrestrial factors. It has been reported that lead and, less frequently, cadmium accumulate in sediments that collect at the bottoms of cisterns and could appear in the drinking water.

Aluminum in water supplies has long been thought to be innocuous, but recently aluminum in water used for dialysis treatment has been associated with senile dementia and dialysis encephalopathy. Due to the relationship between aluminum and these ailments, the development of a maximum contaminant level for aluminum in drinking water has been suggested in the *Federal Register*.

In summary, data now available provide circumstantial evidence that some surface waters in eastern North America are becoming increasingly acidic, particularly lakes in the northeastern United States and Canada. Data for the most potentially sensitive region in the Tennessee Valley, the Southern Blue Ridge Province, also indicate a trend of declining pH and alkalinity in high elevation streams; however, data are insufficient to support a conclusive statement. The cause of acidification has generally been attributed to atmospheric inputs from long-range sources; however, the relative importance of inputs from internal, natural, or nearby atmospheric sources is not known. People who drink water from acidic water sources should be considered at risk of increased intake of lead and possibly cadmium and aluminum. Shallow groundwater sources in areas potentially sensitive to acidification are most likely to be adversely impacted. Thus, available studies indicate that acidic deposition affects water quality in the same complex manner as it affects other areas of the environment--as a contributing factor, not as a single cause of the environmental impacts.

Fisheries

Of all the potential effects of acidic deposition, perhaps none is of greater emotional or scientific concern than the suspected role in the decline of elimination of fish populations. Because fish are near the end of a long and complex tangle of interacting direct and indirect processes, however, there is also perhaps greater uncertainty about effects on fish than on any of the other components of the ecosystem.

Laboratory studies cannot establish a cause-and-effect relationship between acidic deposition and loss of fish populations in the natural environment, but they can and have identified various mechanisms by which acidity can affect fish. It is clear from laboratory studies that acute exposure of adult fish to various levels of acid stress alone can cause lethal or sublethal toxic reactions that affect respiration, acid-base regulation, and ionic and osmotic regulation. The combined effects of acute exposure of adult fish to acid stress, high levels of toxic metals (especially aluminum), and low levels of calcium are less well understood but appear to include loss of salts from blood plasma, gill damage, and copious secretion of mucous that clogs the gills and may lead to suffocation or selectively alter the exchange of ions across the gill surface. Different species, as might be expected, exhibit different degrees of sensitivity or tolerance. Lower levels of chronic acidity or transient surges in acidity in combination with toxic metals may prevent release of mature eggs, fertilization, or normal development during early life stages, thereby reducing reproductive success.

It is clear that some lakes are sufficiently acidic that they will not support some or any species of fish. The actual number and total acreage of such lakes is relatively small, however, and it is not clear how many have been acidic for hundreds or thousands of years, how many may have become acidic more recently, or how many became too acidic for fish as a result of natural factors. In only a few cases are field data available showing that fish populations declined as acidity gradually increased.

There are indications that some lakes and rivers have lost sport fisheries in recent years because of increased acidity. A number of acidic lakes in New York no longer support brook trout. Salmon populations have declined in rivers in Nova Scotia. Loss of fish populations from acidified Canadian lakes near the Sudbury smelter have been documented. In most places there are inadequate historical or modern fisheries data to allow any reliable assessment of possible changes in total fish populations or the diversity and relative abundance of species present.

There are also indications of increasing acidity in a large number of other lakes and streams where loss or decline of fish populations has not yet been documented. There are, in addition, thousands of lakes in North America that must be considered potentially susceptible to increased acidification and decline of fishery resources; these include lakes in Canada, the Adirondacks and other parts of the northeastern United States, the upper midwestern United States, and the Southern Appalachians. Many scientists consider it highly credible that many of these susceptible lakes could become increasingly acidic during coming decades as a result of low capacity to buffer additional acidity from acidic deposition, from natural acidification processes, or from a combination of sources.

Recent assessments by TVA and others indicate that fisheries in the Southern Blue Ridge Province of the Tennessee Valley may be susceptible to the effects of acidic deposition. Several observations in this portion of the Valley, when viewed in light of reported effects on fish populations in the northeastern and midwestern United States, Canada, and Scandinavia, raise genuine cause for concern that a link may exist between these problems and acidic deposition. These problems include (1) the unusually high incidence of spinal deformities in smallmouth bass collected from Chatuge Reservoir in north Georgia and Fontana Reservoir in North Carolina; (2) rainbow trout mortalities in aquaculture facilities in North Carolina following rainfall events; (3) decline in the range of the native Appalachian brook trout over the past several decades; and (4) concern that added stress from acidic deposition may compound problems in areas where fish populations are already stressed by other environmental factors such as toxic discharges from industrial operations and low concentrations of dissolved oxygen.

In the past, concerns about fish habitat and fish populations in the Tennessee Valley tended to focus upon the potential effects downstream from urban and industrial centers in the most developed areas along the Tennessee River and its principal tributaries. As a result, extensive fisheries data are available from many years of routine and special surveys of these areas. The fisheries now considered most susceptible to potential effects of acidic deposition, however, are generally high-elevation streams, lakes, and headwater reservoirs in remote and relatively undeveloped portions of the Southern Blue Ridge Province. Because there has historically been less concern about potential damage to these undeveloped areas, few fisheries surveys have been conducted there. Therefore, there is not an adequate historical data base for comparison with recent data to indicate the nature or extent of any long-term changes that may have occurred in these fisheries in reponse to increased acidity.

Data on smallmouth bass from Chatuge Reservoir confirmed the observations of fishermen that increased numbers of deformed fish have been found over the past five years. Blue Ridge Reservoir, located nearby, has water quality and other characteristics similar to those in Chatuge, but no deformity of smallmouth bass has been reported or identified by sampling. The Chatuge Dam discharge has a median pH of 6.0 and a median calcium level of 1.3 milligrams per liter, while the median values for the Blue Ridge Dam discharge are pH 6.6 and 1.1 milligrams per liter. These water quality characteristics indicate both reservoirs should be low in their ability to neutralize acids.

The absence of significant industrial or agricultural sources of toxic contaminants in the Chatuge watershed, along with the fact that the base water chemistry of the reservoir is of a nature that would be expected to be sensitive to acid input, has led to speculation that the high incidence of spinal deformities may be attributable to acid stress. Research has shown that such deformities can be caused by acid stress as well as a number of other environmental factors, including disease, genetics, nutrition, certain metals and pesticides, and extreme temperature fluctuations at sensitive life stages.

Data collected during 1983 indicated the following information.

1. About 29 percent of the Chatuge smallmouth bass collected had spinal deformities. Deformities were only detected in fish 3 years old and older. No deformities were detected in fish from Blue Ridge.

2. No unusual concentrations of pesticides were detected in fish from either reservoir. The fish appeared healthy, except for the spinal deformity.

3. The vertebrae of yearling bass from Chatuge were weaker than those of yearling bass from Blue Ridge. (Studies by others have indicated that chronic acid stress may interfere with metabolism of calcium and cause demineralization of bone.) The data also suggest that Chatuge bass have lower plasma calcium concentrations than Blue Ridge bass.

4. Smallmouth bass from Chatuge had five to nine times greater whole body zinc concentrations than those from Blue Ridge and other reservoirs. No other metals were found in elevated concentrations. (Laboratory water quality studies reported in the literature have linked zinc with spinal deformities, but no literature has been found that correlates whole body zinc concentrations with bone deformities).

Studies in 1984 have been expanded to other Blue Ridge Province reservoirs, including Fontana, Santeetlah, Nantahala, Thorpe, and Nottley. Preliminary data seem to confirm the greater than 20 percent incidence of deformities in Chatuge and indicate a 28 percent incidence in Fontana. No deformities have been noted in fish collected from Blue Ridge and Santeetlah.

The second concern is trout mortalities in aquaculture facilities. A survey of operators of fish hatcheries supplied with water from various streams draining the Great Smoky Mountains National Park inventoried numerous reports of fish losses in recent years. Some of these losses were reported to be associated with specific storm events.

Perhaps the largest and best documented case occurred in the Raven Fork watershed near Cherokee, North Caroline where about 50,000 rainbow trout died at a commercial facility and an additional 524 trophy-size trout died in three Cherokee Indian ponds following eight storm events between March 31 and December 2, 1981. Strengthening the assumption that acidity had been responsible for these fishkills, no further fishkills occurred at the commercial facility after the practice of adding lime to the creek water was begun, and no more trophy trout died after water from nearby springs was routed to the ponds during subsequent storms. Because of concern that these fishkills might be caused by acidic deposition, TVA undertook studies to determine the cause. The surveys of Raven Fork showed that hydrogen ion and aluminum concentrations in the creek following rain events of one inch or more increased to levels reported to be toxic to trout. The results of a 6-month investigation of the watershed indicated that most of the stream acidity was attributable to weak organic acids of natural origin but did not rule out the possibility that acidic deposition may have been a contributing factor in the trout mortalities.

Another concern is the decline of the Appalachian brook trout, the only trout species native to the mountain streams of the Southern Blue Ridge Province. Its range has declined drastically during the past 100 years because of competition with introduced rainbow trout and poor logging and mining practices. Acidification of poorly buffered streams would further the decline of brook trout populations as well as populations of imported species such as rainbow and brown trout.

A final concern is the possible effect of acidic deposition on existing fishery problems. The development of trout fisheries below TVA dams in the Southern Blue Ridge Province has generally been successful. However, their ultimate usefulness has been hindered by problems with low dissolved oxygen and intermittent flow during late summer and fall. Industrial operations and the presence of toxic materials are also contributing to the problem in some mountain trout streams. Changes in water quality that might be caused by acidic deposition would aggrevate these problems and reduce the usefulness of these fishery resources.

In summary, circumstantial evidence provides cause for concern that a link may exist between acidic deposition and fish populations. Laboratory studies show that acidity alone and acidity in combination with other factors can cause lethal and sublethal effects on adult fish and may reduce reproductive or developmental success. It is clear that some lakes and are too acidic to support fish. It is considered likely that some lakes have suffered loss or decline of fish populations as a result of recent increases in acidity. Many lakes are considered susceptible to increased acidification and possible decline in fish populations. Certain lakes and streams in the Southern Blue Ridge Province in the Tennessee Valley are among those considered susceptible to increased acidity, including the potential effects of acidic deposition. Observations of spinal deformities of smallmouth bass in Chatuge and Fontana Reservoirs, trout mortality in North Carolina aquaculture facilities, and a decline in the range of native brook trout, combined with the possibility that increased acidity might aggravate existing stress on fisheries from toxic industrial discharges and low dissolved oxygen levels and intermittent flows below certain dams, lead to concern about fishery resources in the Tennessee Valley region.

TVA 64 (OS-9-65)

UNITED STATES GOVERNMENT

Memorandum

TO : Kenneth E. Gray, Washington Representative, TWO

FROM : Larry H. Edwards, Manager of Planning and Budget, E6C7 C-K

DATE : April 17, 1984

SUBJECT: ANSWERS TO QUESTIONS SUBMITTED DURING SENATE ACID RAIN HEARING

Attached are answers to questions submitted during the Senate acid rain hearing as approved by the Board of Directors.

Larry H Edwards

Larry H. Edwards

KJH
Attachment
cc (Attachment):
B. J. Bond, 1E61 OCH-K
J. G. Stewart, E12B18 C-K
H. S. Sanger, E11B33 C-K

AH4108.03

1. How much of TVA's reduction in SO_2 emissions from 2.3 to 1.0 million tons per year was achieved through fuel switching or reductions in the use of coal-fired generating capacity.

SO_2 emissions from TVA coal-fired plants decreased from 2.3 million tons in FY 1977 to 1.0 million tons in FY 1983. About 580,000 tons of the decrease (44 percent) was due to switching to alternative sources of eastern low-sulfur coal. About 340,000 tons (26 percent) was due to reduced coal-fired generation. In addition, a reduction of 240,000 tons (18 percent) was achieved by coal washing at TVA built washing plants, 120,000 tons (9 percent) by scrubbing, and 40,000 tons (3 percent) by improving generating plant efficiency.

2. How much of a further 50 percent reduction in TVA's SO_2 emissions would be achieved through fuel switching or reductions in the use of coal-fired generating capacity.

Reducing TVA SO_2 emissions by an additional 50 percent would be accomplished by retrofitting scrubbers to some of the newer and larger base-load plants and reducing the sulfur content of coal at some of the older plants. We would expect about 60 percent of the reduction to come from scrubbing and 40 percent to come from switching to lower sulfur eastern coal, assuming our most probable 1995 coal-fired generation level of 66 billion kWh is realized.

3. Last year the TVA published a study entitled "Investigations of the Cause of Fishkills in Fish-Rearing Facilities in Raven Fork Watershed."

   a. Does TVA disavow or otherwise question the scientific validity of the study?

We do not question the scientific validity of the study. We are concerned that some people have misinterpreted its findings. The investigation did not rule out acidic deposition as a contributing causative factor in *fishkills. This lack of evidence* on the role of acid deposition may be ignored in evaluating the significance of the study to the overall acidic deposition cause-and-effect question. We are also concerned that the study conclusions may be interpreted as applicable to other watersheds. The factors controlling water quality in Raven Fork are very complex. The TVA investigation was a short-term study focusing on stream chemistry and fisheries responses to large rain storms. The study presents valuable information on the possible effects of soils on stream chemistry in Raven Fork. We are continuing our investigations to develop a more complete understanding of the causes of depressed pH and elevated aluminum levels in our region's mountain streams and their relationship to acid deposition.

b. Did any of the TVA directors at any time suggest to the authors of this study that they should in any way modify their conclusions?

No, at no time did any TVA Director suggest to any of the authors of this study that they should in any way modify their conclusions. One of the Directors was concerned that the authors did not explain clearly enough that the findings did not rule out acid rain and he added a comment to this effect to the study as published.

c. Does any other TVA-sponsored research support the proposition that acid rain has caused fishkills in Appalachia?

We have no direct cause and effect evidence that links acid deposition directly to fishkills in Appalachia. However, our research has led us to believe that acid deposition may be one of several factors involved in spinal deformitites in smallmouth bass. It may also be a factor in the decline in the range of native Appalachian trout, and reports of fishkills in other fish rearing facilities. It is our conclusion that acid deposition could be a threat to the Appalachian fisheries.

d. Do you agree with the statement that acid rain has not been shown either to cause or not to cause significant forest damage?

We are not aware of any studies or research that have proven that acid rain is the cause of significant forest damage or that have ruled out acid deposition either as a cause or causative factor in forest damage or productivity decline. However, we are concerned that acid deposition may have played a role in documented changes in growth patterns, productivity, susceptibility to disease, and metals uptake in several important tree species. The circumstantial evidence has added to our belief that acid deposition may be a threat to our region's forests. As with almost every environmental concern, direct cause and effect evidence is seldom available, but the circumstantial evidence continues to mount.

Question by Senator Randolph: How much West Virginia coal does TVA use?

Answer: In fiscal year 1983, TVA used some 670,000 tons of West Virginia coal.

TESTIMONY OF
WILLIAM T. MCCORMICK, JR.
PRESIDENT AND CHIEF OPERATING OFFICER
AMERICAN NATURAL RESOURCES COMPANY
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
U. S. SENATE
FEBRUARY 9, 1984

Mr. Chairman, Members of the Committee. I am William T. McCormick, Jr., President and Chief Operating Officer of the American Natural Resources Company. American Natural is a diversified energy company, that is involved in the production of low sulfur coal in the eastern United States.

I am appearing before you today on behalf of the Alliance for Clean Energy. ACE, as we are known, is a coalition of coal producers, transporters and consumers with over 30 member companies who would be directly impacted by pending acid rain legislation.

ACE membership includes most of the low sulfur coal producers in the United States with members in the east with operations in West Virginia, Virginia, Kentucky, Tennessee and Alabama, and in the west in Wyoming, Montana, Colorado, Utah, North Dakota and New Mexico.

ACE recognizes that acid rain is one of the most difficult issues facing the Congress and the country today. The environmental and economic consequences of legislating, or not legislating, a solution are enormous. Yet there remains substantial disagreement among experts about the science surrounding the causes and effects of acid rain.

ACE does not offer judgments on the state of the science of acid rain nor are we here to actively support a particular piece of legislation. What counsel we do offer to this Committee today is derived from two premises:

- First, that many members of Congress concluded in the last Congress -- and may do so again this year or in 1985 -- that a legislative solution to the acid rain phenomenon is required. Consequently, if legislation is to be enacted, ACE wants to share with this Committee our views based on our experience and judgment.
- Second, that as a group of coal producers, transporters and consumers, we know coal markets; we know the coal employment situation; and we understand the economics of coal use.

A COST EFFECTIVE SOLUTION

The essence of the ACE position is that if Congress decides to enact acid rain control legislation, it should be the most cost effective. And to be cost effective it must permit utilities to freely make the best economic choice between switching to low sulfur coal and scrubbing. Mr. Chairman, I am pleased that these concepts are embodied in the bill this Committee reported in the last Congress.

ACE's position in favor of utility freedom of choice and against national mandatory scrubber legislation is based on several simple but, we believe, compelling arguments:

1. There are vast quantities of abundant and inexpensive low sulfur coal in the east as well as in the west which, if desired, can be used to substantially reduce sulfur emissions.
2. In most cases, utilities can achieve sulfur reductions much less expensively by converting to low sulfur coal rather than investing in and operating costly scrubbers.
3. Manadatory scrubbing legislation can, realistically, only be funded through a national tax which penalizes those regions of the country which have already achieved low SO_2 emissions levels.
4. SO_2 emissions can be reduced more rapidly using low sulfur coal and the large sludge disposal problem associated with scrubbers can be avoided.
5. The relatively modest reduction in high sulfur midwest coal mining jobs can be largely offset by jobs created in adjacent eastern low sulfur areas.

Mr. Chairman, let me discuss each of these points in more detail.

Abundance of Eastern and Western Low Sulfur Coal

There is a common myth that has been promulgated by supporters of mandatory scrubber legislation that low sulfur coal largely exists only in the west and, thus, switching to low sulfur coal will only entail use of western coal. This is simply untrue.

As Exhibit 1 shows, current economically recoverable U.S. low sulfur coal reserves amount to 7.6 billion tons in the east and 8.0 billion tons in the west, for a total of over 15 billion tons. The U.S. Department of the Interior's estimate of in-place low sulfur reserves is even higher at a total of 193.8 billion tons with 26.5 billion tons in the east.

These reserves of low sulfur coal are very large compared to recent U.S. annual production of low sulfur coal (see Exhibit 1)* of only about 280 million tons of which 200 million tons was in the east. Furthermore, the current additional productive capacity of low sulfur coal, as estimated by Chase Econometrics, is another 115 million tons in the east and another 90 million tons in the west.

Thus, it is clear that there is ample low sulfur coal reserves and capacity in both the east and the west to substantially reduce sulfur emissions without the need for widespread scrubber use. In fact, less than 100 million tons/year of additional low sulfur production capacity would be needed to reduce SO_2 emissions by 7 million tons/year.

Mr. Chairman, low sulfur coal can contribute greatly to further SO_2 reductions as it has in the past. For, despite a 15% increase in coal use from 1970 to 1980, SO_2 emissions dropped 21% with 80% of the reductions due to use of low sulfur coal.

---

*Exhibits attached to this statement have been retained in committee files.

Cost of Scrubbing vs. Use of Low Sulfur Coal

A recent Congressional Office of Technology Assessment study (see Exhibit 2)* concluded that mandatory scrubbing would cost U.S. consumers $1.4 billion per year more than a "freedom of choice" policy permitting utilities to reduce emissions by using low sulfur coal. This represents about $30 billion of additional electricity costs to U.S. consumers over the next 20 years. Studies by ICF, Inc., who have performed several analyses for the U.S. Environmental Protection Agency, (see Exhibit 3),* place the savings of a "freedom of choice" policy at $2.0 billion/year or over $40 billion of additional consumer costs.

The reason the costs of scrubbing are so high is easy to understand. According to DOE estimates (see Exhibit 4)* the capital cost of a scrubber that would remove 90% of the sulfur in Illinois basin coal is $122/KW of capacity in 1982 dollars or $61 million of capital cost for a 500 MW plant.. At 11% interest rate, the interest alone is about $7 million/year with total amortization of the investment at about $9 million/year. At a plant throughput of 1.2 million tons/year, the capital cost alone amounts to about $7.50/ton of additional cost. As shown in Exhibit 4, the annual operating costs for a scrubber on a 3.5% sulfur coal is about 4.6 mills/KWH or about $9/ton. So, overall, a scrubber would add about $16/ton (1982 $) or about $18/ton in 1984 dollars to the cost of processing each ton of coal.

---

* Exhibits attached to this statement have been retained in committee files.

Mandatory Scrubbing - Who Should Pay?

The proponents of mandatory scrubbing legislation have argued for a national utility tax to spread the enormous costs of scrubbing to consumers throughout the U.S. However, currently, there are only 9 states, including Ohio, Illinois and Indiana, that significantly exceed the EPA emissions levels; the remaining states have successfully implemented their State Implementation Plans by incurring the costs and taking the necessary actions to reduce emissions. Thus, there is a real equity issue involved. It is our view that consumers in most regions of the U.S., which already have achieved low SO_2 emissions, should not be taxed to pay for scrubbers in a few states that have not reduced emissions.

SO_2 Can Be Reduced Faster By Using Low Sulfur Coal

A sulfur reduction program based on switching to low sulfur coal could be implemented to 2 or 3 years. A capital intensive mandatory scrubbing program would take 5 to 7 years to implement as outlined in the Sikorski-Waxman Bill (H.R. 3400) where 1990 is the target year for substantial reductions.

The reasons for the differences in timing are two-fold:

- First, designing, engineering, fabricating and constructing costly customized scrubbing units takes a minimum of 4 to 5 years before full operation.
- By contrast, because of the availability and abundance of eastern and western capacity of low sulfur coal, utilities can easily and quickly shift to low sulfur

coal. In fact, two utilities in my state, Michigan, have recently announced such shifts beginning less than one year from now.

Exhibit 5[*] illustrates how a freedom of choice strategy allowing switches to low sulfur coal, as contrasted with mandatory scrubbing (under the House introduced Sikorski-Waxman bill), can lead to earlier reductions in SO_2. By 1990, cumulative SO_2 emissions under the freedom of choice strategy are 33% or 9 million tons lower than mandatory scrubbing. By 1993, a mandatory scrubbing policy still results in fewer cumulative emissions. It isn't until 1995 that a program of mandatory scrubbing equals freedom of choice strategy and then, only at a very high cost to U.S. consumers.

The Jobs Issue

The propopents of mandatory scrubber legislation have argued that job losses in the midwest would be 50,000-80,000 if utilities were allowed to use low sulfur coal to meet lower sulfur emission requirements. ACE believes these estimates are grossly overstated and that this issue is poorly understood, in part, because of the common misunderstanding of the large amount of current and potential eastern low sulfur coal mining jobs.

In discussing coal mining jobs, Mr. Chairman, it may be instructive to review historical trends. Between 1923 and 1969, employment in bituminous coal mining in the U.S. fell from more than 704,000 to fewer than 125,000, a decline of 82%. By 1979, however, employment in America's mines had doubled to more than 250,000 and is expected to increase to nearly 350,000 by 1995 as coal use continues to increase.

---

*Exhibits attached to this statement have been retained in committee files.

In order to put the employment question in some perspective, ACE commissioned several outside studies and ANR performed its own analysis, comparing a feasible, least cost approach involving low sulfur coal (similar to S. 768) and the mandatory scrubber approach of Sikorski-Waxman (H.R. 3400). (See Exhibit 6).*

These studies, including a recent study by ICF, Inc., concluded that there are only two states -- Ohio and Illinois -- that would lose more than 1000 high sulfur coal mining jobs as a result of a "freedom of choice" policy which permitted compliance using low sulfur coal. By contrast, 17 states would gain more than 1000 low sulfur mining jobs including Virginia, West Virginia, Kentucky, Arkansas, Louisiana, Texas, New Mexico, Colorado, Utah, Wyoming, Montana, North Dakota, Arizona, Oklahoma, Alabama, Pennsylvania and Indiana.

Since the total estimated mining employment loss in Ohio and Illinois is estimated to be less than 12,000, and associated service jobs might be another 12,000, the annual cost of a mandatory scrubber program would be almost $80,000/year per job saved -- a very costly jobs program.

We do not mean to make light of job losses in any state. However, we would note that some of the highest unemployment in the mining fields is in low sulfur coal producing areas, in Virginia, eastern Kentucky and southern West Virginia. In fact, if mandatory scrubber legislation were enacted, it is certain that there would be job losses in the low sulfur coal mining regions as the small economic premium for low sulfur coal vanishes.

---

*Exhibits attached to this statement have been retained in committee files.

It is clear that the relatively modest reduction in high sulfur midwest coal mining jobs that would occur under a freedom of choice bill would be largely offset by new jobs created in adjacent low sulfur eastern coal regions. However, to the extent there are dislocations, these can be addressed through a targeted assistance program to affected miners rather than a costly scrubber program for the nation.

It is clear, in general terms, that the job impact of the kind of acid rain control program this committee is considering is far from the catastrophe some would have you believe.

New Technology Development

Let me turn now to new technology for scrubbers.

As you well know, the current generation of scrubbers has problems and are far from ideal. Technological controls are currently expensive to install and just as costly to operate. And the current generation of scrubbers merely transform one environmental problem to another. For example, it is estimated that 3 1/2 tons of sludge must be disposed of for each ton of SO_2 removed by conventional scrubbing. This is an issue which has received almost no serious attention from the environmental community and those who advocate mandatory scrubbing.

A national program which mandates installation of the current technology of scrubbers over the next six years would virtually foreclose development of new technological approaches. The huge capital expenditures necessitated by mandating scrubbers also absorbs funding for necessary research and development and would displace the funding for improved technologies. At the same time it would drastically penalize the rest of the economy and the nation.

Emission Caps and Offsets

Consistent with ACE's position that acid rain reduction be achieved in a cost effective manner, we also recommend that the Committee not include emissions "cap" and "offset" provisions in the earlier Committee-reported bill. These mechanisms for limiting SO_2 are both economically inefficient and administratively burdensome, and could needlessly hinder industrial growth.

For example, emissions offsets in areas which have already cleaned up may simply not be available. States such as Louisiana and Connecticut, which rely mainly on gas- or oil-fired electrical power, currently produce little SO_2. The construction of coal-fired industrial boilers in those States could produce emissions for which offsets are unavailable. And there may be as many as eight other States, who are already in compliance with their State Implementation Plans, including Arkansas and Michigan, which could have problems finding the reductions needed to accommodate growth. Offsets for these States may be available only through interstate trades, whose feasibility is untested.

CONCLUSION

Mr. Chairman, acid rain control legislation will have a significant effect on the long-term U.S. energy supply/demand picture. Coal is clearly the fuel of choice for baseload generation of electricity. It is less expensive than alternative fuels and has the potential to further reduce dependence upon imported oil. Increasing the use of coal for domestic electricity generation should thus be a high priority. Yet, certain acid rain legislative alternatives involving mandatory scrubbing will greatly constrain the increased use of eastern and western low sulfur coal -- with little or no environmental benefit.

Congress, in the context of fashioning acid rain legislation, can and should only revise the environmental laws in a manner assuring that our environment will be protected without undue cost to consumers. Such a revision requires doing several things.

First, in any new legislation environmental goals should be attained at the least cost. Mandatory use of scrubbers should be avoided, replaced with clear and definite performance standards, allowing those burning coal to elect the least cost method of complying with those standards.

Second, conversion to coal from alternative fuels should be encouraged, again by setting clear, reasonable performance standards for those units.

Third, new technology must be developed quickly to permit the clean burning of high -- as well as low -- sulfur coal. Legislative barriers to implementation of new technology should be avoided. A freedom of choice strategy will give the greatest incentive to new coal technology developments.

Employment displacements within the ordinarily volatile coal industry should be addressed directly by assistance targeted to those whose employment is threatened without massive distortions to the coal market.

Mr. Chairman, all we ask is that the Federal government give low sulfur coal producers the chance to compete by rejecting policies which would consciously exclude us from the marketplace at the expense of the consuming public.

Thank you for the opportunity to present our views. I will be happy to answer any questions you may have.

Office of Government Relations
Robert G. Weymueller, Director
Fran DuMelle, Associate Director
1101 Vermont Avenue N.W. · Suite 402
Washington, D.C. 20005
(202) 289-5057

AMERICAN LUNG ASSOCIATION
The Christmas Seal People ®

HEALTH EFFECTS of the PRECURSOR POLLUTANTS of ACID DEPOSITION

Statement of

Alfred Munzer, M.D., Chairman
Government Relations Committee

American Lung Association

to the

Environment and Public Works Committee
United States Senate

February 9, 1984

National Headquarters 1740 Broadway, New York, N.Y. 10019 • James A. Swomley, Managing Director

Mr. Chairman, members of the Committee, I am Alfred Munzer, a practicing physician specializing in diseases of the lung. As chairman of the American Lung Association/American Thoracic Society Government Relations Committee, I am appearing today on behalf of the American Lung Association. The ALA is the nation's oldest voluntary health association and has had an abiding concern with the health effects of polluted air. We believe that a review of the scientific literature on air pollution demonstrates clearly the contribution of air pollution to the development and/or exacerbation of the various lung diseases. It is on the basis of our knowledge of the adverse health effects of air pollution that the ALA places high priority on the reauthorization of a Clean Air Act which will continue the progress towards clean and healthful air quality in all regions of the country.

Today I would like to briefly review the health effects of exposure to the sulfur oxide pollutant complex, one of the percursor pollutants of acid deposition. I have based my comments on a publication of the ALA which reviews recent research findings on sulfur oxides. This report, "Sulfur Oxides and Public Health: Evidence of Greater Risks", was entered into this Committee's hearing record during previous testimony on S. 768 November 15, 1983.

The emissions of sulfur-bearing compounds from burning coal and oil need to be controlled more effectively. Despite government efforts, nearly 30 million tons of sulfur oxides are emitted from these sources into the air each year in the United States. These pollutants remain airborne for long periods of time and may travel great distances, creating high concentrations far from emission sources.

Sulfur dioxide is the main sulfur product of combustion. As the sulfur content in the fuel increases so does the level of sulfur oxides. Once emitted, this gas reacts in the atmosphere to prodouce compounds such as sulfuric acid and sulfate salts which exist as microscopic particles up to 50 times smaller than the diameter of human hair. These particles from aerosols remain suspended in the air for considerable lengths of time. As such, they may be carried by the winds hundreds of miles from their source.

Sulfate compounds dominate the mass of fine particles (those less than 1 µm in diameter) in most areas of the United States, averaging 35 percent of the total fine-particle mass. (1) The acidity of aerosol particles correlates closely with sulfate concentrations, with sulfuric acid comprising 20 to 45 percent of the total sulfate mass. (2,3)

Ambient air concentrations of fine particles have, at best, remained unchanged over the past several years; in many areas, increases have occurred. Generally, the highest levels occur during the summer months. These levels are driven upward by the sulfate component. (4-6)

Annual concentrations of sulfate particles in the United States average 9-13 µm/m^3, while levels twice as high may occur over large areas of the Northeast during the summer, lasting for 12 or more hours. (3, 7-9) Moreover, the northeastern United States may also experience episodes during which sulfuric acid concentrations exceed 25 µg/m^3. (3) Thus, the Northeast may experience both annual and short-term elevations of sulfate pollution, particularly during the summer. Additionally, SO_2 concentrations are substantially higher than sulfate levels in large portions of the Northeast, but unlike sulfate, SO_2 are highest in the winter months. Nonurban average and peak ozone levels are also elevated in the Northeast, with the highest levels occurring during the summer months. (7)

To pinpoint and analyze the effects of pollutants, researchers conduct toxicological studies with experimental animals, clinical studies of humans exposed under controlled conditions, and epidemiological studies of large populations exposed under highly variable ambient conditions. Health studies have focused on the impact of sulfur pollutants on the clearance of foreign matter from the respiratory tract and defenses against infectious agents, respiratory mechanics, aggravation of respiratory and cardiovascular disease, and mortality. I will review some of the findings from human clinical studies which will be a very brief summary of the voluminous material available.

Clinical studies with human subjects allow researchers to investigate the responses of both healthy and special at-risk individuals to different modes and durations of exposures. Such studies have shown that SO_2 affects various physiological functions, including sensory processes, perceptions of irriation or pain, and respiratory function. The health significance of sensory responses appears to be minor. In healty subjects at rest, respiratory and cardiovascular responses have been consistently observed at exposure levels of 5 ppm. The findings of several investigators suggest potentiation of SO_2's airway effects with mouthbreathing and increased exercise levels, or both. Studies suggest bronchoconstriction in healty adults orally breathing SO_2 concentrations of 1.0 to 2.5 ppm. (8-10)

Of greater concern is the impact of SO_2 on hyperreactive individuals--those particularly sensitive to airway constriction. Such individuals include asthmatics and persons with disorders such as hay fever and other allergies.

Systematic study of the effects of SO_2 on asthmatics was initiated in 1980 when researchers observed bronchoconstriction, sometimes with wheezing and shortness of breath, at concentrations less than 1.0 ppm. In some asthmatics bronchoconstriction occurred at levels as low as 0.25 ppm. (11-15) In another study, however no effects were noted at 0.25 ppm. (16) Recently reported research show that 0.5 ppm SO_2 (the lowest level administered) potentiated the response of asthmatics to cold, dry air. (17) This group of experts concluded that "people with asthma may be more sensitive to bronchoconstrictor effects of ambient SO_2 in cold, dry environments than in warm, moist environments."

The heightened response of asthmatics to SO_2 may be due in part to increased respiration caused by the initial irritancy of the gas. The findings that people with asthma and disorders such as hay fever are more sensitive to SO_2 and that this sensitivity is increased by mild exercise are consistent with the theory that bronchial hyperreactivity is in part associated with an increase in reflexive responses in the airways.

Inhalation of sulfuric acid mist (0.35 to 5.0 mg/m^3) increases respiratory rate and decreases airflow rates and breathing volume, according to some studies with healthy adults. Other studies have indicated that pulmonary function is almost totally unaffected by 0.1 to 1.0 mg/m^3 sulfuric acid for

10 to 120 minutes. One researcher found that the bronchoconstrictor action of carbacol was potentiated by sulfuric acid and sulfate aerosols generally in proportion to their acidity. One study found that mucociliary clearance of the trachea and bronchus was increased at 100 μg/m^3, and decreased at 1000 μg/m^3. (18) The decreased clearance rates, while transient, raise the possibility of more persistent or chronic depression of clearance with repeated exposure to the same concentration of sulfuric acid.

In studies with asthmatic subjects, changes in airway function have been demonstrated after exposure to sulfuric acid at concentrations less than 1000 μg/m^3. At 500 μg/m^3 and higher, reduction in airflow and the volume of air that can be exhaled have been observed in adult ashtmatics after sulfuric acid and ammonium bisulfate exposures. (19) In a group of adolescent asthmatics exposed at rest for only one-half hour, followed by 10 minutes moderate exercise, significant changes in pulmonary function occurred with a sulfuric acid concentration of 100 μg/m^3. (20)

The evaluation of public health risks from air pollution is a seemingly straightforward matter--a series of dose-response relationships are applied to a set of pollution measurements of population exposure. These determinations, however, are subject to considerable disagreement within the scientific community. Effects thresholds, response measures, and dosage estimates are some of the issues debated by pollution researchers. Still, while opinions differ on the magnitude of effects from exposure to air pollutants, the consensus is that increased air pollution and in particular increased SO_2 emissions, will be associated with worsened health of the general public. Under severe pollution conditions, each incremental $\mu g/m^3$ increase in sulfate levels may cause 1 to 14 deaths per 100,000 persons per year according to various risk estimates. (3, 21-23)

The efforts by federal, state and local authorities to reduce pollution of the air by sulfur oxides have achieved mixed results. While concentrations of sulfur oxides near emission sources have lessened considerably, concentrations of SO_2 and its transformation products--sulfuric acid and other sulfate species--many miles away from these sources have, at, best, remained the same and, in certain areas of the United States have increased. So much attention on the long-range transport of sulfur pollution has been given to ecological effects--acid rain-- that many have overlooked the effects on public health that this long-range transport poses.

The observed effects on asthmatics of SO_2 at 0.25 to 5.0 ppm and of sulfuric acid at 100 $\mu g/m^3$ should be taken into account in making decisions regarding control strategies for SO_2. These effects are likely to occur at SO_2 and sulfate levels in the ambient air. Their seriousness is reflected by the fact that airway obstruction and symptoms such as wheezing and dyspnea are among factors considered by physicians in determining the need to hospitalize asthma patients.

Both the elevated sulfate and SO_2 concentrations combined with elevated ozone levels increase the health risks to those people with preexisting illnesses, those spending time out of doors, and those engaged in outside physical activity. This group includes asthmatics, people with allergies, those with pulmonary and cardiovascular disease, those involved in outdoor occupations, children, and the elderly.

I have confined my remarks to the health effects related to the sulfur oxide pollutant complex. SO_2 reductions which could be achieved through acid rain control legislation will have a dual benefit to the American people providing environmental benefits as well as reducing a potential public health threat. Therefore, the ALA supports control strategies to achieve significant reductions in emissions of sulfur oxides from major stationary sources. We would urge that any such strategies adopted be incorporated into a comprehensive reauthorizations of the Clean Air Act.

Thank you for this opportunity to present our views.

REFERENCES

1. Atmospheric and Environmental Research, Inc.: Study of role of transport in fine and total suspended particulate air quality. AER report prepared for NCAQ, Washington, D.C. NTIS publication no. PB81-168031, 1981.
2. Ferek, R.J. A study of aerosol acidity over the Northeastern United States. Cooperative thesis no. 68, Florida State University and National Center for Atmospheric Research, 1982.
3. Ozkaynak, H., et al: Analysis of health effects resulting from population exposures to ambient particulate matter--health and environmental effects document, 1982. Prepared for US Department of Energy, Agreement no. DE-AC02-81EV10731 by Harvard University, Cambridge, 1982.
4. Pace, T.G., et al: Preliminary interpretation of inhalable particulate network data, presented at 1981 annual meeting of the Air Pollution Control Association, 1981.
5. Trijoinis, J., et al: Statistical analysis of TSP and meterological data in EPA region 6, USEPA report no. EPA 906/9-79-005, 1979.
6. Spengler, J.D., et al: Mass and elemental composition of fine and coarse particles in six US cities, presented at the annual meeting of the Air Pollution Control Association, 1982.
7. U.S. EPA: Review of the national ambient air quality standards for particulate matter--revised staff paper, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 1981.

8. Lawther, P.J., et al: Pulmonary function and sulfur dioxide, some preliminary findings, Environ Res, 1975, 10, 355.

9. Melville, G.N.: Changes in specific airways conductance in healthy volunteers following nasal and oral inhalation of SO_2, West Indian Med J, 1970, 19, 231.

10. Snell, R.E. and Luchsinger, P.C.: Effects of sulfur dioxide on expiratory flow rates and total respiratory resistance in normal human subjects, Arch Environ Health, 1969, 18, 693.

11. Sheppard, D.A., et al: Exercise increases sulfur dioxide induced bronchoconstriction in ashtmatic subjects, Am Rev Respir Dis, 1981, 123, 55.

12. Sheppard, D.A., et al: Lower threshold and greater bronchomotor responsiveness of asthmatic subjects to sulfur dioxide, Am Rev Respir Dis, 1980, 122, 873.

13. Koenig, J.Q., et al: Acute effects of inhaled SO_2 plus NaCl droplet aerosol on pulmonary function in asthmatic adolescents, Environ Res, 1980, 22, 145.

14. Koenig, J.Q., et al: Effects of SO_2 plus NaCl aerosol combined with moderate exercise on pulmonary function in asthmatic adolescents, Environ Res, 1981, 25, 340.

15. Koenig, J.Q., et al: Bronchoconstrictor responses to sulfur dioxide or sulfur dioxide plus sodium cloride droplets in allergic, non-asthmatic adolescents, J Allergy Clin Immunol, 1982, 69, 339.

16. Linn, W.S., et al: Respiratory responses of young adult asthmatics to sulfur dioxide exposure near simulated ambient exposure conditions, Environ Res, 1982, 24.

17. Bethel, R.A., et al: Potentiation of sulfur dioxide-induced bronchoconstriction by airway cooling, Environ Occup Health, 1981, 161.

18. Leikauf, G., et al: Effects of sulfuric acid aerosol on respiratory mechanics and mucociliary particle clearance in healthy nonsmoking adults, Am Ind Hyg Assoc J, 1981, 42, 273.

19. Utell, M.J., et al: Inhaled particles. V. Proceedings of the 5th international sysposium, Cardiff, Wales, September, 1980, Pergamon Press, London, 1981.

20. Koenig, J.Q., et al: The effects of inhaled sulfuric acid on pulmonary function in adolescent asthmatics, Am Rev Respir Dis, 1983, 128.

21. Lave, L.B. and Seskin, E.P.: Air pollution and human health, The Johns Hopkins University Press, Baltimore, MD, 1977.

22. Morgan, M.G., et al: A probabilistic methodology for estimating air pollution health effects from coal-fired power plants, Energy Systems Policy, 1978, 2, 287.

23. Bozzo, S.R., et al: Health effects of energy use, BEAD, National Center for Analysis of Energy Systems, July, 1978.

Statement
by
Ruth Gonze, Assistant Legislative Director
AMERICAN PUBLIC POWER ASSOCIATION
before the
Senate Committee on Environment and Public Works
on
ACID RAIN CONTROL LEGISLATION

February 9, 1984

Mr. Chairman, thank you for this opportunity to present the views of the American Public Power Association (APPA) on acid rain legislation. I am Ruth Gonze, assistant legislative director of APPA. Accompanying me this morning as technical advisor is Michael Bergman, APPA staff scientist.

The American Public Power Association is the national trade organization that represents approximately 1,750 local publicly-owned electric utilities throughout the United States, Puerto Rico, the Virgin Islands, Guam and American Samoa. About one out of every six consumers in this country is served electricity by a public power utility. As such, the Association is the largest consumer representative group for utility matters in the United States.

APPA supports acid rain legislation which can meet reasonable standards of fairness, cost-effectiveness and equity. Fairness will be judged by those who will be asked to bear the costs of a control program. Cost-effectiveness will be determined by achieving meaningful reductions in the impact of acid rain while keeping energy costs to the consumer as low as possible. And equity will be obtained by asking all of those contributing to the problem to contribute their fair share.

As suppliers of electric power -- about two-thirds of which is derived from fossil fuels -- our members are willing to pay their fair share. Yet as representatives of millions of consumers, we also have a responsibility to ensure that costs are not unfairly apportioned and that an acid rain control program can achieve its objectives of preserving the environment for generations to come with a minimum in economic disruption.

We believe that the policy positions adopted by APPA's Special Task Force on Acid Rain in mid-summer 1983 offer a potential consensus approach for Congress to balance these objectives of fairness, cost-effectiveness and equity. I would like to spend the next few minutes outlining the major provisions of our position and the reasons underlying their adoption by our Task Force. The full text of the Policy Report of APPA's Special Task Force on Acid Rain is reproduced as Attachment A to this testimony.

We know this Committee appreciates the potential seriousness that acid rain poses to sensitive ecosystems. Yet national efforts to lessen the potential damage from acid rain may cost vast sums of money, approaching $50 billion to $80 billion over the lifetime of various programs now before the Congress. While a scientific consensus seems to be emerging that acid rain is a problem and should be controlled -- as embodied in the recent panel study of the National Academy of Sciences and the report to the White House's Office of Science and Technology Policy -- controversy still exists among reasonable and responsible scientists as to the causes, sources, extent and effect of acid precipitation. Apparently, all that can conclusively be stated at this time is that all fossil fuel combustion emissions from both local and distant sources may be involved, including sulfur, nitrogen, chloride, and, perhaps, trace element emissions.

As consensus has grown around the need for meaningful acid rain controls, controversy has emerged as to the acceptable mechanisms for instituting and paying for these controls. APPA believes -- based on the support from all regions of our membership -- that a reasonable balance of consumers' interests for a clean environment with the need for reliable electrical power at a reasonable cost requires consideration of the following key principles in acceptable acid rain legislation:

1. There should be a nationwide funding mechanism based on SO2 and NOx taxes on emissions from all fossil-fueled sources.

2. Funds raised should be applied to the most cost-effective emission reduction measures.

3. Emission reductions should be based on a "pay as you go" approach.

4. The reduction program should have two phases, with implementation of the second phase based on an affirmative decision by the Congress.

5. Emission reduction goals should adequately account for future growth.

Each of these points will be addressed in turn.

1. National Emissions Tax

We believe a nationwide funding mechanism for acid rain controls is essential. While APPA believes that the costs of cleanup should be borne by sources contributing to the problem insofar as reasonably possible, the already economically distressed industrial Midwest could face unacceptable additional burdens without some means of financing support. Further, areas throughout the United States may be sensitive to effects from acid deposition and a nationwide approach avoids drawing arbitrary boundary lines between those who are and who are not liable to the costs of control.

APPA opposes the funding mechanisms contained in some legislative proposals which would tax kilowatt-hours or other units of measurement not related to the source of the problem. The problem is the emission of pollutants and the solution should be a tax on those emissions.

The nationwide funding mechanism should be applied to SO2 and NOx emissions on all mobile and stationary fossil-fueled sources for which an emissions tax is feasible. Sources specifically include cars and trucks, smelters, industrial boilers, industrial processes, and utility boilers. "Feasibility" would be an administrative determination.

An emissions tax is superior to all other funding mechanisms for the following reasons:

- it credits past clean-up efforts;
- it provides incentive for future clean-up;
- it is regionally equitable;
- it offers ancillary benefits; and,
- it is administratively workable.

An emissions tax provides credit for past cleanup efforts and incentives for future cleanup. For example, since the early 1970s, sources have reduced their sulfur dioxide emissions by many millions of tons. Under approaches relying on kilowatt-hour taxes, these reductions would not be acknowledged. And, with regard to incentives for future cleanup under an emissions tax, SO2 may be reduced without mandated reduction measures through avoidance of the tax.

One of the major points of dissension surrounding a kilowatt-hour funding mechanism is that areas with low emissions, especially in the West, are charged with a disproportionate share of the cost of the program.

In addition, under an emissions tax, reduction of tax payments resulting from lower emissions in areas not sensitive to acid rain can produce ancillary benefits such as improved visibility. Perhaps the key point, then, is that irrespective of the sensivity of a particular region to acid rain, an emissions tax offers at least some measure of benefit to all.

Administrative difficulties have been raised as an argument against an emissions tax. APPA believes this issue is a red herring. For sources which continuously monitor their emissions, determining actual emission levels is an obviously straightforward matter. For the majority of remaining sources, calculations based on fuel-sulfur content are easily made. In any case, fixing tax liability for ranges of emission levels -- such as is now done for personal income taxes -- should result in defensible and verifiable tax liabilities without imposing undue administrative burdens.

APPA, for the reasons stated above, does not agree with the argument that because everyone uses electricity or because it is administratively simple to tax electricity generation, a kilowatt-hour tax is superior to an emissions tax.

2. Funds Used to Pay for the Most Cost-Effective Emission Reduction Measures

APPA believes that the monies raised through the emissions tax should be used to fund the most cost-effective and verifiable emission reduction measures. Such measures for SO2 reductions specifically include fuel switching, fuels pretreatment, flue-gas desulfurization ("scrubber") systems, and other measures now under development whose performance can be verified over the course of the program.

Estimates for the cost savings of a cost-effectiveness approach as opposed to an approach mandating "continuous emission reduction technologies," or scrubbers, have been conservatively placed at 25 percent. Given present uncertainties in source-to-receptor relationships for acid rain and the absolute lack of evidence that SO2 emissions reduced through scrubbing offer any benefits over other SO2 reduction measures, requiring continuous emission reduction technologies only should be rejected on simple economic grounds.

APPA acknowledges that certain emission reduction measures, specifically fuel switching, are politically controversial on economic, not environmental grounds. However, even if fuel switching is legislatively limited, the use of a cost-effectiveness standard is valid. The program's cost-effectiveness over other approaches would be lessened but not lost. Even assuming that large unemployment impacts from excessive fuel-switching would occur and are unacceptable, such impacts should be examined carefully to minimize extra costs. We believe that analysis will suggest measures other than the complete prohibition of fuel-switching -- including minimum limitations on fuel switching or adoption in defined cases of retraining and relocation programs -- which may adequately deal with case-specific objections where they arise.

In deciding cost-effectiveness, APPA urges that site-specific factors limiting the practicability of retrofit, operation and maintenance costs, capital costs, and the useful remaining lifetime of facilities be considered. In essence, this recommendation suggests a life-cycle costing basis for evaluating emission reduction measures.

Because the objective of an acid rain control program is to lessen damage to sensitive ecosystems, there may be instances where the cost-effectiveness criterion may need to be waived in order to target emission reductions to source areas that are demonstrably impacting selected receptor areas. However, since present science does not yet allow these determinations to be made, provisions for targeted reductions do not appear to be warranted at this time. If and when such determinations are made, APPA would support a targeted reduction program.

3. A "Pay As You Go" Approach

APPA urges that whatever form of legislation is passed embody a "pay as you go" or "clean as you pay" strategy. This recommendation means that the financing program would remain in effect until emission reduction goals are met, and that sources required to reduce emissions at the end of the program are assured of having the same financing support as those required to make reductions at the beginning of the program. Programs based on unrealistic promises backed by inadequate funding will be accepted reluctantly if at all by consumers and industry alike.

4. Two-Phased Reduction Program

APPA supports a two-phased reduction program, with the continuance of the second phase contingent upon affirmative action of the Congress that the program is achieving its objectives. Given the substantial scientific uncertainties that presently exist, the very large costs associated with any reduction program, and the likelihood that improved information upon which to base decisions will be developed in the future, this recommendation assures that mid-course corrections can be made in the program if necessary. Also, by splitting the program into two phases, greater incentive is provided to achieve the most cost-effective emissions first.

Complementary to a two-phased program is continued and enhanced acid rain research and the establishment of an adequate monitoring program.

5. Emission Reduction Goals Must Account for Future Growth

APPA urges that any emission reduction goals proposed in acid rain legislation adequately account for future growth. APPA can not accept emission caps or requirements for "offsets" which would act to preclude future industrial growth.

This recommendation means that without a proper accounting of growth from new sources, overall emission reductions are understated. Further, new capacity is subject to a "double whammy": firstly, by paying for control technologies to meet new source performance standards; and, secondly, by paying for "offsets" from existing sources for the emissions that remain after NSPS control. These offsets, by the way, will be some of the most costly and difficult to obtain, since the easier emission reductions at existing sources would have already been claimed to meet the emission reducion goals of the acid rain control program.

Mr. Chairman, these five points constitute the major features that APPA believes should be included in any acceptable acid rain legislation. In addition, we urge that the Committee also consider the following points in their deliberations:

- to include adequate provisions for monitoring and continued research;
- to base emission taxes on actual rather than allowable emissions; and,
- to allow electric utilities the discretion to include their contributions to the emissions tax as a line item on utility bills.

In conclusion, Mr. Chairman, APPA believes that our recommendations are geared to address the public interest. We are willing to take responsibility for the costs and requirements of acid rain controls in direct proportion to our responsibility for the problem.

To date, the American Public Power Association is the only national electric utility organization to embrace a comprehensive program for dealing with acid rain control legislation. Significantly, though, more than 10 statewide and regional utility associations have followed APPA's lead and have endorsed similar programs. We believe that our proposals point the way to effective, workable and meaningful grounds for consensus in dealing with one of the most difficult environmental issues of our times.

We urge the Committee to study our Special Task Force's Policy Report in detail. We believe that our joint responsibilities to both consumers and the electric utility industry alike have allowed us to craft a position that transcends parochial interests. Our actions demonstrate that fair and equitable acid rain legislation can be crafted that meets the needs of our nation's various regions.

As a final note, Mr. Chairman, APPA would like to reiterate that what we are proposing is a framework and set of goals for legislation. Because of the complexity inherent in any approach to control acid rain, APPA hopes that the Congress will see fit to establish the targets and approach to be followed in acid rain legislation, but will leave the specific details to the regulatory process where it can be handled most appropriately.

Mr. Chairman, I thank you and the Committee for the opportunity to present APPA's views on this subject of keen national interest.

Attachment A

POLICY REPORT
OF
APPA SPECIAL TASK FORCE ON ACID RAIN

August, 1983

I. Introduction

At the request of APPA President Robert McKinney, a 25-member Special Task Force on Acid Rain was convened in Washington, D.C., on August 10 and 11, 1983. The purpose of the Task Force is to provide interim policy guidance to APPA staff, within the framework of the Association's acid rain resolution approved on May 3, 1983. This guidance is needed to specify the positions APPA should take on proposals relating to such issues as national taxes or fees to provide a cleanup fund, and how burdens should be spread across specific regions, industries, ratepayers, or consumers. APPA's policy resolution establishes general criteria by which legislation should be evaluated, but does not address these crucial issues. Because this is a national issue potentially affecting all utilities, the Task Force has a broad geographic base, including utilities which are wholesale purchasers as well as generators of electricity. Most members of the Task Force are members of the Legislative and Resolutions Committee.

The action of the Task Force serves as interim policy subject to review or modification at the next meeting of the Legislative and Resolutions Committee in February, 1984.

II. General Conclusions: The Necessity to Support Effective and Equitable Acid Rain Control Legislation

There is now a substantial likelihood that Congress will enact legislation mandating sulfur dioxide (SO_2) emission reductions in the near future. Momentum for legislation has grown as a consequence of several developments of serious import.

These include: increasing public concern that acid precipitation resulting from fossil fuel combustion may be causing environmental damage; mounting congressional support for legislation; the recent publication of two new scientific reports which strengthen the case for action; and the Reagan Administration's anticipated endorsement of acid precipitation control legislation.

Public opinion polls indicate that an overwhelming majority of Americans favors stronger environmental protection laws, including acid precipitation control requirements. A majority of Americans indicates a willingness to pay the costs of such programs. Local public power systems share the concern of the communities they serve that the natural environment be protected.

As public concern has grown, so has congressional support for legislation. In the last Congress, legislation providing for an acid rain control program was approved by the Senate Environment and Public Works Committee. In the

98th Congress, proposals have proliferated and gained substantial cosponsorship. Most of these proposals target electric utilities almost exclusively for emission reductions; target electric consumers to pay the costs; and contain no consideration of cost-effectiveness in the control measures proposed.

Hearings are expected to begin in the House and Senate in the early fall, 1983. Predictions for the legislative timetable vary, but enactment in 1984 is widely agreed to be probable.

In June, 1983, the case for immediate action was bolstered by two scientific reports. A White House scientific "peer review" panel convened to assess the acid rain problem issued a statement of its preliminary findings, saying: "Recommendations based upon imperfect data run the risk of being in error; recommendations for inaction pending collection of all of the desirable data entail even greater risk of damage." Furthermore, the panel raised the specter of "irreversible" damage from acid rain.

At the same time, the National Academy of Sciences' National Research Council issued a report supporting a link between the level of sulfur dioxide and nitrogen oxide (NO_x) emissions and the level of acidity in precipitation. In the press release (though less clearly in the report), it was stated that "the relationship between [SO_2] emissions and [acid] deposition can be taken for practical purposes as essentially linear," meaning that most or all SO_2 is converted into sulfate-derived acids. While this statement may be challenged on scientific grounds, and inaccurately describes the conclusions of the text of the report, nevertheless the imprimatur of the National Academy of Sciences must be taken with the utmost seriousness. The statement of the White House scientific panel underscores the weight which the Academy's views must be accorded.

The Reagan Administration, which previously supported only accelerated acid rain research efforts, is now in the process of revising its position. The Administration is expected to propose legislation in early September which is likely to include substantial reductions in SO_2 emissions.

Thus, the acid rain debate now increasingly centers on how, not whether, to structure an acid rain control program. The Task Force believes that, if current predictions regarding the time frame within which legislation will be formulated are correct, public power systems have a vital opportunity now to participate in the design of legislation.

Acting upon that opportunity is made more urgent by the serious deficiencies which the Task Force believes most current bills contain. Public power systems have a responsibility to participate in the formulation of legislation to ensure that its provisions meet reasonable standards of effectiveness, economy, and equity within the framework of present scientific understanding.

APPA's policy resolution on acid rain control legislation sets these standards as criteria against which legislation should be evaluated. APPA's resolution also notes that many pending legislative proposals "would impose emission cuts exclusively on electric powerplants without regard to: other stationary or mobile source contributions; total cost; relative cost-effectiveness of different emission reduction measures; ascertainable benefits; and equitable distribution of cost burdens...."

If the present opportunity to participate in the design of legislation is foregone, then the program finally enacted may fail, by default, to meet the essential standards set out in Association policy.

Therefore, by unanimous vote on August 11, the Special Task Force on Acid Rain adopted a series of recommendations regarding acid precipitation control legislation as detailed in Part III of this report.

The Task Force has endeavored to ensure that the positions supported in this report meet the criteria for acid precipitation control legislation which are set out in the Association's policy resolution approved by the general membership on May 3, 1983. The positions of the Task Force are not intended to constitute a comprehensive legislative proposal. For example, the Task Force does not attempt to resolve such issues as the extent to which emissions should be reduced or the time frame within which such reductions should occur, although Task Force members concur that initial reductions should be moderate and the time frame adopted should not require exorbitant annual taxation levels. Instead, the positions are intended to serve as a set of coherent principles for legislation.

III. Recommendations for Acid Precipitation Control Legislation

The Task Force proposes 10 specific elements of a legislative program. These proposals and the rationale for their adoption follow:

1. *A nationwide sulfur dioxide and nitrogen oxide emissions tax should be applied to all fossil-fueled sources for which an emissions tax is feasible.*

This is the most far-reaching of the Task Force's recommendations. It specifies a taxing mechanism, its geographic applicability, the pollutants to be taxed, and the source categories to which the tax is to be applied.

The Task Force rejects schemes without financing (or "cost-sharing") mechanisms, as embodied in last year's Senate Environment and Public Works Committee acid rain proposal. There are a number of reasons to reject legislative approaches which do not contain financing mechanisms. They include the large uncertainties associated with the eventual capital requirements of an "open-ended cost" bill; the prospect of drastic impacts on the economies of several already distressed states, as well as upon individual utilities; the political unacceptability of such impacts; and the implicit, but unavoidable, assumption that long-range transport is the dominant mechanism leading to acid deposition.

Three cost-sharing schemes were investigated in detail:

- kWh tax;
- Btu tax;
- emissions tax.

One of the leading proposals being considered in Congress at the present time is the Sikorski/Waxman bill (H.R. 3400), which would impose a 1 mill per kilowatthour fee on all non-nuclear electric generation, including hydroelectric generation. Senator John Glenn (D-OH) has proposed a 3 mill per kilowatthour fee on fossil fuel generation in a 31-state region. While the Task Force recognizes the administrative simplicity of a kWh tax, it rejects an electricity tax because it unfairly targets utility customers to pay all control costs. Further, an electricity tax does not recognize or credit emission reductions already achieved by individual utilities and their ongoing costs to ratepayers; nor does it provide incentives for future cleanup. The problem is not the consumption of kilowatthours, but the emission of pollutants that can lead to acid precipitation.

A Btu tax -- either at point of sale or as a levy on energy inputs to boilers, industrial processes, or other combustion sources -- is disadvantageous for some of the same reasons: it neither credits emission reductions achieved nor gives incentives to reduce emissions. In addition, a Btu tax would account inadequately for emissions from nonferrous smelters -- where significant emissions result from sulfur in the ore and not in the fuel -- and would be administratively complex.

After detailed evaluation, the Task Force supports an emissions tax as the best available alternative: (1) it fairly apportions the tax liability to those sources contributing most to the precursors causing acid rain; (2) it credits past cleanup; and (3) it provides incentives for emissions reductions, since any reduction will reduce tax liability. An emissions tax best addresses the sources of acid rain in a manner which is economically efficient.

Though substantial attention has been given to regional application of the tax, the Task Force concurs that a nationwide tax is preferable. First, a regional tax may be unconstitutional (Article I, Section 8, of the U.S. Constitution states that all "Duties, Imposts and Excises shall be uniform throughout the United States."). Also, although the Task Force's consensus was that costs of cleanup should be borne by emitting sources insofar as reasonably possible, the Task Force appreciates that there is substantial political opposition to strict application of this principle and that the already economically distressed industrial Midwest could face unacceptable additional burdens.

Other facts as well support a nationwide approach. Foremost among these is scientific evidence that areas throughout the United States may be sensitive to effects from acid deposition, and that acid deposition has been documented in many states outside the Northeast. Finally, a nationwide approach avoids drawing arbitrary boundary lines between those who do and do not pay a tax.

The Task Force supports an emissions tax on both sulfur dioxides and nitrogen oxides. Tax applicability to both is based on the strong scientific evidence that both SO_2 and NO_x contribute to acid deposition.

The Task Force agrees with the scientific evidence that all fossil fuel combustion can create precursors to acid deposition, and therefore recommends that SO_2 and NO_x emissions from all fossil fuel sources should be liable to the tax so long as it is feasible. Source categories specifically include cars and trucks, smelters, industrial boilers, industrial processes, and utility boilers. The caveat, a test of "feasibility," is included to account for the potential difficulty of applying an emissions tax to many small stationary sources or to the nation's existing population of cars and trucks. Note, however, that all fossil fuel sources should be included in initial consideration for taxation, and should be excluded only if an emissions tax is shown to be infeasible to administer.

2. *The fund derived from the tax should be employed to finance verifiable emission reduction measures.*

Funds raised should be applied to measures (not merely "technologies" like scrubbers) which will reduce emissions in accordance with the reduction goals to be specified in legislation. The Task Force specifically recognizes the following SO_2 emission control measures: 1) fuel switching; 2) fuels pre-treatment, including physical coal cleaning, chemical coal cleaning, and oil desulfurization; 3) flue-gas desulfurization systems (scrubbers) on nonferrous smelters, industrial and utility boilers, and other industrial processes; and 4) any other emission reduction measure now under development whose performance can be verified during the term of the program. The Task Force considered a recommendation to set aside a portion of the fund for the demonstration of advanced pollution control or energy-efficient technologies, but chose not to adopt a position because support for demonstration of such technologies may best be considered in EPA or DOE appropriations.

3. *The purchase of emission reduction measures should not be mandated in excess of the monies available in the fund.*

Sometimes described as a "clean as you pay" strategy, this requirement would ensure that legislation promises no greater reduction in emissions than can realistically be achieved by the fund. By keying emission reductions to the funds available, sources required to reduce emissions at the end of the program are assured of having the same financing support as sources required to reduce emissions at the beginning of the program. This provision would keep the legislation honest. In practical terms, this recommendation means that the financing program would remain in effect until emission reduction goals are met, and would not expire at an arbitrary date. Also, this provision would require that the cost of the program be acknowledged at the program's inception, thereby setting a cap in any given year on the national expenditures devoted to address the acid rain problem.

4. *The fund should be applied to the capital costs of the control measures chosen.*

Under various financing schemes, either capital costs or operation and maintenance costs -- or percentages of both -- have been considered for eligibility to receive funding. Because of the potential difficulties in raising the large amounts of capital which may be required for individual sources mandated for control measures, the Task Force supports their application to capital costs only. In instances where scrubbers may be mandated, capital costs are roughly equivalent to operation and maintenance costs over the lifetime of a facility. While the Task Force is fully aware that operation and maintenance costs could be a significant cost burden for those mandated to install controls -- particularly for many large sources in the industrial Midwest -- the Task Force also recognizes that this cost burden would be lessened somewhat by the decrease in the emissions tax which would accompany an emissions reduction program at individual facilities.

In those instances where fuel pre-treatment may be the mandated emission control measure, the Task Force supports the use of monies in the fund for installing additional capacity for treatment as necessary. Fuel pre-treatment specifically includes coal cleaning and oil desulfurization.

Fuel switching often entails capital costs. For example, precipitator redesign or the use of baghouses may be required when switching to low sulfur coal. Such costs would obviously be covered under the fund. When fuel switching does not involve capital costs, no monies would be made available from the fund, though any higher costs associated with using premium low sulfur fuels would be somewhat compensated by lower emission tax liability.

5. *Emission reduction measures for stationary sources should be selected in order of cost-effectiveness, including consideration of the remaining useful life of facilities, with allowance made for administrative consideration of the likelihood of reducing impact in sensitive receptor areas.*

Since the Task Force lacks expertise in emission reduction measures which may be feasible for mobile sources such as cars and trucks, the Task Force is silent on the question of mobile source control. For stationary sources, however, the Task Force emphatically supports pursuit of control measures which give the "biggest bang for the buck" -- achieve the largest possible reductions at the lowest possible cost. Not only is this cost-effectiveness criterion the most economically efficient approach, but, in the absence of definitive identification of source-to-receptor relationships, it best responds to scientific uncertainties.

Though not specifically addressed in this recommendation, the consensus of the Task Force is that both SO_2 and NO_x emission reductions should be eligible for financing, but that NO_x reductions should be discretionary and creditable to overall SO_2 emission reduction goals. Thus, for example, lowering excess air in boilers to reduce NO_x would not be mandated, but individual sources could receive funding to install low NO_x burners should they be found cost-effective.

The Task Force urges that cost-effectiveness judgments on control measures weigh: the site-specific factors limiting the practicability of retrofit of control measures; operation and maintenance costs; capital costs; and the useful remaining lifetime of the facility receiving control. In essence, this clause stipulates application of a life-cycle method of costing to individual facilities.

In many cases, fuel switching may be the most cost-effective control measure. Task Force members are unanimous in supporting fuel switching as an option to reduce emissions. The Task Force is aware, however, that political, not economic, parameters may eliminate fuel switching as a permissible control option.

The Task Force notes that application of a cost-effectiveness standard would benefit the nation with costs at least 25 percent lower than those entailed by approaches which rely on "continuous emission reduction technologies" (that is, scrubbers).

Consideration of the "likelihood of reducing impact in sensitive receptor areas" provides for some form of targeting emission reductions to either particular regions or to particular emission sources should scientific evidence so warrant.

6. *The emission reduction program should be divided into two phases, with the second phase to take effect contingent upon affirmative congressional action, including findings that the program is achieving its objectives.*

This proposal takes account of three facts central to the acid rain dilemma. First, present scientific data have yet to determine adequately the extent of damage from acid rain, the rate at which that damage is occurring, and the individual sources that may be causing such damage. Second, legislation to address acid rain is likely to impose a formidable cost burden on the nation. And third, scientific evidence in the years to come may allow fine-tuning of the emission reduction program. By requiring affirmative action by the Congress to proceed with a second phase, the practical result is to allow for mid-course review and correction. Also, by setting emission reduction goals in two phases, a greater incentive results to reduce the cheapest emissions first, thereby bolstering a cost-effectiveness approach.

7. *The program enacted should provide for adequate monitoring and continued research to gauge the effectiveness of the emission reduction program.*

Obviously, for mid-course review and correction to be possible, additional information on the effects of measures taken must be available. This recommendation assures that the national resources expended on acid rain controls are in fact achieving their objectives. The Task Force urges strongly that an adequate monitoring program be established which could demonstrate a decrease in the impact of acid rain or in the acidity of deposition to justify the substantial monies expended.

In addition, the Task Force strongly supports the acid rain research efforts presently underway, and urges stepped up efforts in a number of key areas of scientific uncertainty. Foremost among these areas is the role of natural acidification from humic or other organic acids in disturbed habitats. The Task Force also believes that the present debate over the role of local sources vs. long-distance sources needs to be refined in the context of the contributions to acid rain from burning different fossil fuels; specifically, does oil combustion have a greater likelihood of adverse impact than coal combustion? Finally, the Task Force believes greater attention should be paid to the rate at which damage from acid rain is occurring, determinations which would be assisted by more extensive ice-core sampling and controlled field experiments. These recommendations are in addition to the excellent recommendations for additional research made in the recent National Academy of Sciences report.

8. *Emission taxes on stationary sources should be based on actual rather than allowable emissions.*

Many industrial and utility sources do not operate full-time. For these sources, tax liability should reflect their actual contribution to the problem -- that is, actual emissions.

The Task Force addresses this recommendation only to the case of stationary sources. It may be necessary and practical to tax mobile sources on expected -- rather than actual -- emissions. For example, new automobiles could be taxed at point of sale based on measured emissions per mile over their expected lifetime.

9. *No requirements for offsets for new facilities should be included in the emission reduction program.*

Like the policy above which stipulates that control funds expended should not exceed the emission tax collected, this provision would keep legislation honest. For example, emission reduction goals which do not account for future growth underestimate the total reductions required. When such underestimates occur, new sources are forced to find additional emission reductions from existing sources in order not to exceed emission ceilings. Yet, the existing sources from which these "offsets" must be obtained may be the very same sources that are being required to reduce emissions under the general provisions of the reduction program. Thus, not only would offsets be scarce and difficult to obtain, but they would also be extremely expensive. Under this scenario, it is also likely that small sources would be placed at a competitive disadvantage in buying offsets.

Therefore, any emission reduction goals stipulated in legislation should properly account for future growth. Furthermore, the Task Force is skeptical about the viability of the emissions trading or offset approaches that have been advanced in acid rain proposals.

10. *Electric utilities should have discretion to include their contribution to the emissions tax as a line item on utility bills.*

Given the large overall costs, and disproportionately larger costs for specific utilities, of an emissions reduction program, the Task Force supports discretion to utilities to specify to their consumers why electric rates may be rising.

Respectfully submitted,

Dan Waters
Los Angeles Department
of Water and Power
*Chairman, APPA Special Task
Force on Acid Rain*

August 19, 1983

Comments on the Acid Rain Issue

William B. Harrison
Senior Vice President
Southern Company Services, Inc.
Birmingham, Alabama

Senate Committee on Environment and Public Works

February 9, 1984

I am William B. Harrison, Senior Vice President, Southern Company Services, which is affiliated with Georgia Power Company, Alabama Power Company, Gulf Power Company, Mississippi Power Company, and Southern Electric International to comprise The Southern Company. It is my pleasure to present this statement in behalf of the Edison Electric Institute, an association of investor-owned electric utility companies, as well as the Southern electric system.

In the year 1711, Alexander Pope said "A little learning is a dangerous thing." I cannot find a more appropriate or more relevant quotation to characterize the current acid rain issue. What I see is a frenzy of environmental activism, political rhetoric, and media sensationalism based on an overly simplistic and superficial view of causes and effects of acid rain. A few facts, laced with many assumptions, are being used to give to the public the appearance of justification for a massive, urgent, and very expensive program of sulfur dioxide abatement as if, when implemented, the perceived impacts of acid rain will go away.

Pope went on to say, "Drink deep or taste not the Pierian spring. There shallow draughts intoxicate the brain. And drinking largely sobers us again." The point I am trying to make is that superficial and sensational stories about acid rain may be interesting, even exciting, to some readers and profitable to certain environmental organizations who generate them and the media who disseminate them, but a great disservice is being done to the public in the process because they are too shallow. They are based on a "little learning."

Where do we start?

The rush to acid rain legislation is based largely on assumptions which cannot be justified by currently known facts. The public is being told that there is significant and extensive damage from acid rain already evident and that the situation is rapidly worsening; that sulfur dioxide (SO_2) is the main cause of acid rain and that SO_2 abatement is the preferred way to reduce or "eliminate" acid rain; that, since coal-fired electric power plants are emitters of SO_2, they must be the principal targets for control; and that, since the New England states include some acidified lakes, reducing emissions from upwind electric power plants in other regions of the country is the best way to restore the acidified lakes and prevent others from becoming acidified.

The report on acid deposition sponsored by the National Research Council (National Academy of Sciences) (1)*, which has been given much publicity in recent months, refers to the data from the Hubbard Brook (N.H.) Experimental Forest as "the longest continuous record of deposition data at a receptor site in the northeastern United States." Accordingly, it is instructive to examine the data in the context of the message being given to the public as summarized above. Figure 1 is taken directly from the National Research Council report. The data shown are yearly averages of information from 1965 through 1981. Please note that the trends over this time span are not large, and may not be very significant, but there are important questions which arise from a close examination. Note that sulfate (SO_4) concentrations are declining slightly. Sulfates are the oxidation products of SO_2 and it is clear that the data do not suggest a worsening situation related to SO_2. The nitrates are increasing slightly. Since nitrates are the oxidation products of the oxides of nitrogen (NO_x), one wonders why the rush to legislation is so relatively silent about NO_x abatement.

---

*Numbers in parentheses refer to references in the Bibliography.

What is the problem?

Far more significant are the slight decline in hydrogen ion concentration and the slight increase in pH, meaning that acidity levels in the precipitation have been decreasing slightly at Hubbard Brook since 1965. If this is the most credible information available, one must ask "What is the acid rain problem?" Acidity levels are going down. There is no evidence of worsening levels of acidity in the trends. There is no indication that SO_2 emission control is needed, or that rapid changes are taking place. The lack of significant or rapid changes in precipitation acidity is confirmed elsewhere by studies of the U. S. Geological Survey and the Utility Acid Precipitation Study Program at monitoring stations over a larger geographic area but for a shorter period of time (9, 19).

What about lake acidification?

The acid rain legislation proponents find it convenient to sweep aside the information cited above with the argument that some lakes in the Northeast are too acidic to support desirable fish populations, which is sufficient proof that acid rain is a major problem demanding a legislative remedy. Ignored is the basic fact that many of these lakes were known to be acidic long before the major urban growth in the Northeast or the industrial growth of the Midwest. Also ignored is the fact that lake acidity is influenced far less by inputs of acidity from precipitation than by the high acidity naturally present in forest litter (2) and in wetlands (3), or by the natural buffering capacity (or lack thereof) in the soils surrounding these lakes (4). In all lake studies which have addressed this question to date, acid rain has been found not to be the factor controlling lake acidity (21). In addition to factors already noted, soil and forest types, and forest and land management practices are important determinants of lake acidity (8). The

Integrated Lake Watershed Assessment Study of the Electric Power Research Institute (EPRI) has shown no change in average acidity in three lakes being studied in the Adirondacks over the last five years (4). The same study developed a model explaining marked differences in the acidity levels of these lakes, all of which were subject to essentially the same precipitation. With the model, it was shown that either doubling or reducing by half the atmospheric input of sulfur would not produce a meaningful change in lake acidity. Sediment cores from acid lakes indicate that many of them became acidic thousands of years ago (10). As the case implicating acid rain in lake acidification has become more difficult to prove, allegations have been made that acid rain is the cause of damage to forests, crops, and even human health. These allegations have not been substantiated, but extensive research efforts may be required to either verify or disprove them. In some cases, effects are being attributed to acid rain which properly should be attributed to other causes (11, 12, 13).

What causes rain to be acidic?

The assumption that sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) contribute to acidity of rain is not being challenged. Though the media direct attention primarily to emissions from electric utilities, there are many sources of these gases in the atmosphere other than, or in addition to, electric utilities, and there are other chemical substances in the atmosphere which control the pathways by which these gases react to become acids (7). The simplistic perceptions which focus attention on electric utilities generally ignore other sources of SO_2 and NO_x, such as private homes, automobiles, factories, etc., and they also ignore other influential chemical substances in the atmosphere.

Even if one accepts the fact that SO_2 and NO_x from all sources, natural and man-made, are major precursors of acids in precipitation, a number of very basic relationships still remain unclear. There are major uncertainties related to the rates of chemical reactions, the relative importance of catalysts and oxidants in the reactions, the form and mix of reaction products, etc. Just as there are conflicting and confusing data on the rates at which SO_2 reacts to form sulfate ions (SO_4), so also are the data concerning the degree to which the deposition of sulfate ions can be regarded as a measure of acidic input. Obviously, sulfate ions can react with hydrogen ions to form sulfuric acid, but they also can react with other ions to form compounds which are not acidic (14, 15). Hence, sulfates are not necessarily appropriate measures, or surrogates, for acidity.

Other areas of uncertainty relate to quantification and location of natural sources of acid precursors. An example may be found in studies which estimate the generation of NO_x by lightning (16), revealing it to be a source too large to be ignored.

Where is the acid rain coming from?

Still another unresolved issue relates to the relative contributions of local and distant sources to specific receptor areas (17). Distant upwind sources may not be as important contributors to acid rain in the Northeast as the aggregation of local sources which are smaller but closer and more numerous. Implicit in this issue are the required development and verification of models which can realistically relate deposition rates to source strength and distance, meteorological data, and atmospheric chemistry. The recent National Research Council report (1), previously referenced, addresses this issue in this way:

"The actual limitations of predictive models for calculating the effects of sources on sulfate deposition are not well defined because of deficiencies in knowledge of atmospheric processes and the lack of coherent regional data on air quality and deposition. No studies of the validity or limitations of models for nitrate concentrations have been performed. No model for wet deposition of acidity has been developed that takes account of sources and distributions of all the important ions in precipitation."

What kind of legislation is being proposed?

Numerous legislative proposals have been made to "control acid rain." Though they differ in the extent of control to be achieved, there are a number of premises they have in common: (a) lakes in the northeastern U. S. and eastern Canada are being acidified by acid rain; (b) sulfur dioxide (SO_2) emissions are the principal cause of acid rain; and (c) the way to control acid rain is to reduce sulfur dioxide emissions of electric utilities, principally in the Middle West because large plants are located there and the region is upwind of the Northeast.

As referenced earlier, there is now available evidence from highly credible sources, including the referenced report of the National Research Council (1), sufficient to cast serious doubt concerning each of the premises cited above. If preventing lakes from being acidic is the objective of the legislation, controlling utility emissions cannot be a cost-effective strategy.

Figure 2 illustrates the relative magnitudes of SO_2 emissions from electric utilities and other selected emission sources, expressed as emission densities (tons emitted per year per square mile of land area) for each of the states in the region proposed for legislative restrictions in most pending bills. (Chemical reactions are influenced by concentrations of reactants rather than total amounts. For this reason, emission densities, crudely proportional to concentrations, have greater significance than total emissions in the context of relationships between emissions of SO_2 and NO_x as precursors of acids in the environment. Emission densities also show a more objective comparison of emissions from different states.) Though utility emissions are significant, the magnitude of emissions from other sources is comparable and, in some cases in the Northeast, larger than the utility emissions.

Figure 3 shows the comparison of NO_x emission densities for utilities and mobile sources. (Data for industrial NO_x emissions are not available.) In most of the northeastern states, mobile NO_x emissions far exceed the utility emissions.

Figure 4 combines the data of the first two figures to give an indication of the total man-made precursors for acid rain formation.

Together, these figures show clearly that any acid rain control strategy which addresses only the electric utility facilities with high emission rates is ignoring other major sources, some of which could be far more important contributors to acid rain in the Northeast.

With these statements as background, consider S.768* as an example of the proposed bills to control acid rain. In brief, all electric utilities in the 31 states bordering on and east of the Mississippi River, by 1992, must collectively reduce emissions of sulfur dioxide by 8 million tons per year below their actual emissions in 1980. The amount of emission reductions required in each state is based on the extent to which emissions in 1980 exceeded 1.5 pounds of sulfur dioxide per million British thermal units (Btu) of heat released in the utility boilers. This simple language has very interesting consequences.

---

*S.768 introduced by Senator Stafford, March 1983.

Figure 5 repeats the emission densities for SO_2 and NO_x that are shown in Figure 4, with adjacent bars showing the emissions allowed after the required reductions. It is noteworthy that emission densities would change only slightly or not at all in the region in which acid rain is of greatest concern.

Figure 6 repeats the emission densities of Figure 4, but rearranges the order and superimposes the required emission reductions expressed as percentages of 1980 emissions. It is interesting that, of the four states with greatest emission densities, Ohio and Indiana must reduce emissions 36% and 39%, respectively, but New Jersey and Massachusetts must reduce emissions only 4% and 8%, respectively. On the next highest plateau of emission densities, note that Pennsylvania and West Virginia must reduce emissions by 22% and 33%, respectively, but Delaware must reduce by only 7%. Rhode Island and Connecticut do not have to make any reductions at all, though their emission densities are significantly greater than 22 other states affected by the proposed legislation.

What will the legislation accomplish, if adopted?

It is significant that most legislative proposals for protecting the lakes of the Northeast have not taken into account serious efforts to estimate the change in acidity of precipitation which can be expected from the proposed emission reductions. Though only an estimate and without any claim for scientific rigor, the best work on this subject currently available is from the Energy Laboratory at Massachusetts Institute of Technology (18). Several cases were examined, but the one most meaningful here is a comparison of the effects of present emissions from all sources and the alternative of eliminating SO_2 emissions from all power plants. The geographic area of the study is bounded on the west by a line from the SW corner of Tennessee to the NW corner of Illinois and then east to the NE corner of New Hampshire and south to the SE corner of North Carolina. The resulting difference in precipitation acidity was 0.2 pH units. It is very instructive to compare this estimated incremental change in pH, obtained through emissions reductions far greater than in most legislative proposals, with the normal fluctuation in pH at a given place. For example, take another look at the pH data from Figure 1 at Hubbard Brook. The net effect of this drastic elimination of SO_2 would not be significant when compared with the normal variation of pH in the region for which much of the proposed legislation is "justified."

It should be kept in mind that a 50% reduction in deposited hydrogen ions, defined as an objective by some investigators, would represent a change of acidity of the order of only 0.3 pH units. In the context of pH variations ranging from about 4.0 to 6.5 for precipitation in regions throughout the world having little impact from man-made emissions of SO_2 and NO_x, there is a good basis for questioning the change of precipitation acidity levels which can reasonably be expected from currently proposed legislation (5, 6).

An additional point which seems to be overlooked is that emissions from electric utilities are destined to decline in the future as existing plants are replaced with new sources, including coal-fired sources subject to New Source Performance Standards and nuclear facilities. In some areas of the country, including the Northeast, there has been a significant decline in SO_2 emissions as a result of compliance with the Clean Air Act amendments of 1970 and 1977. Of special interest in connection with proposed legislation is the fact that the investor-owned utilities in Illinois, Michigan, Indiana, Ohio, Kentucky, and West Virginia, along with the Tennessee Valley Authority, effected an actual 2-1/2 million ton reduction in annual SO_2 emissions over the years from 1975 through 1982. Five acid-precipitation monitoring stations, operated from 1979 through 1982 in Ohio, Massachusetts, North Carolina, and Indiana, have shown no difference in acidity of rainfall as a result of this change in emissions. Though further analysis is needed, sufficient data are available to justify skepticism about the effectiveness or usefulness of further emission reduction proposals at this time.

Still another consideration is the cost of proposed legislation. A recent analysis of data from 24 utility companies revealed that implementation of the emission control strategy proposed in S.768 would involve $15 billion in capital costs and $4 billion in annualized costs (20). These companies comprise less than half of the total generation in the region affected by the legislation and would be responsible for only 3.6 of the 8 million ton SO_2 reduction that would be mandated in the bill. Prospective investors in the long-term securities offered by regulated electric utilities would view the use of this capital as counterproductive, since it would not create additional electrical capacity from which increased revenue streams would be derived. This view would give rise to an additional measure of uncertainty that could make the financing of the new capital burden impossible or, at best, so costly that the electric system's customers and investors both would be adversely affected.

Another consequence of currently proposed acid rain legislation will be a loss of employment in the United States. As energy costs rise to accommodate the nonproductive cost increases imposed by compliance with the legislation, the U. S. competitive position in world markets will be damaged. The U. S. International Trade Commission has estimated that for each billion-dollar change in the trade deficit, now at about $70 billion, there is a loss of 25000 jobs.

The electric utility industry contends that these costs should not be incurred, based on the present level of understanding of the benefits which can be achieved. A rational plan of acid rain control must await the necessary information to show that legislative proposals address real problems with strategies judged to be effective in providing benefits which are commensurate with the costs. Otherwise, a grave injustice will have been done to an unsuspecting and trusting public.

What is the objective of acid rain control legislation?

Critical to any discussion of emissions control is a clear definition of what is to be achieved. Specifically, the answers to two questions are needed. First, what is to be reduced if SO_2 emissions are controlled: lake acidity, acidity of precipitation, total sulfate deposition, total sulfur deposition, ambient particulate sulfate, or total atmospheric sulfur? These six answers are not all mutually exclusive, but some degree of exclusivity does exist among them. Answering this question requires identification of resources at risk and the degree to which each must be protected. If a scientific or intellectual rationale exists for reducing any or all of them, a second question is where should these reductions take place: in specific regions, over the eastern part of the country, or over the entire lower 48 United States? The answers to these two questions have an all-important bearing on the need for and nature of control strategy, and should form the basis for determining if, in fact, any legislation is needed.

Is there a rational approach to the acid rain issue?

It should be borne in mind that the electric utility industry, through the Electric Power Research Institute (EPRI), already has conducted major studies related to acid rain and intends to expand its research efforts in relevant science and technology: the sources and the physical and chemical processes which form acid rain; the physical, chemical and biological processes which control aquatic or other effects of acid rain; the spatial and temporal variability of acid rain; the quantity and value of resources at risk from acid rain; and control technology for abatement of acid rain precursors, should additional controls prove to be warranted. The currently planned five-year program (1984-1988) of EPRI includes a total of $476 million for programs relevant to this issue, $175 million of which directly addresses the unresolved questions which must be answered in order to develop a rational control program. EPRI efforts are undertaken by some of the most capable and credible scientists and engineers in the nation. The quality and scope of this program, one of the largest in the world on acid rain science and technology, sets the electric utility industry apart from those who are attempting, through allegations which have little basis in fact, to gain public support for urgent and sweeping legislative remedies for the acid rain "problem."

No other nongovernmental party to the acid rain debate can offer so much objective, scientifically and technically valid information to be used in resolving this issue. Some of the excellent work by EPRI in the areas of atmospheric chemistry and ecology has been referenced in the recent report by the National Research Council (1).

The other major participant in developing needed information is the Interagency Task Force on Acid Precipitation (ITFAP) which was established by the Acid Precipitation Act of 1980 to oversee the planning and implementation of the National Acid Precipitation Assessment Program. Prior to this act of Congress, acid precipitation research was conducted in a piecemeal fashion by a number of Federal agencies. The ITFAP has organized these efforts into a coordinated program. Twelve Federal entities constitute the ITFAP and the funds for acid precipitation research are included in the respective participating agency budgets. However, the entire budget is planned as a unit and reviewed as a single entity by the Office of Management and Budget. The lead agencies are the National Oceanic and Atmospheric Administration, the Department of Agriculture, and the Environmental Protection Agency (EPA). Federally funded acid deposition research has doubled from about $11 million in FY 1980 to $22.3 million for FY 1983.

The EPRI program of work is planned in the context of the National Precipitation Assessment Program. Among the leadership of these programs, there exists a spirit of cooperation and mutual respect, as well as a seriousness of purpose which accompanies work of national significance.

Summary

The conclusion drawn here is that there is time to gather enough information to determine whether (a) there is a problem which demands a solution, (b) there are solutions which can be implemented, and (c) the particular solution(s) to be implemented will be cost-effective and in the public interest. Until this information is obtained, even minimal interim control measures are not justified.

In exploiting the misconceptions noted here, public and political perceptions have been managed in a way that focuses attention on sulfur emissions and sulfate deposition, while ignoring the factors which control acidity of the lakes. Most legislative proposals for acid rain control have been justified by concern for the lakes, but proposed solutions cannot be cost-effective and are only partially relevant to lake acidity. In opposing these legislative proposals, the electric utility industry is trying to protect its customers from wasteful and ineffective programs which cannot produce benefits commensurate with their costs. Cost sharing and taxing schemes have been advanced to make various proposals more palatable, but, regardless of who pays what portion of the total bill, these proposals cannot constitute sound social investments so long as commensurate benefits cannot be expected.

Through its prior efforts and its announced plans, the Electric Power Research Institute and others in the electric utility industry are taking responsible roles in developing an understanding of the acid rain issue and the technology to implement countermeasures if needed. This work is pursued diligently and cooperatively with other responsible parties, including the Federal government.

The electric utility industry position is based on the most credible information currently available, and its interpretation of this information is strongly substantiated by information in the recent National Research Council report. It is hoped that reason and intellectual honesty can be more strongly emphasized as the acid rain debate continues, and that the public can be shown the need for cautious deliberation rather than precipitous legislation. The electric utility industry intends to be fully responsive as new information is gathered and will reevaluate its position from time to time as appropriate.

Bibliography

Following references are representative of information sources cited. Other supporting references are readily available.

1. Acid Deposition, Atmospheric Processes in Eastern North America, Committee on Atmospheric Transport and Chemical Transformation in Acid Precipitation, National Research Council, National Academy Press, Washington, D. C., 1983

2. Everett, A. G., W. C. Retzsch, J. R. Kramer, I. P. Montanez, and P. F. Duhaime, Hydro Geochemical Characteristics of Adirondack Waters Influenced by Terrestrial Environments, Everett & Associates, Rockville, Md., December 1982

3. Molliter, A. V., and D. J. Raynal, "Acid Precipitation and Ionic Movements in Adirondack Forests," Soils Science Society Journal, Vol. 46, 1982, p. 137-141

4. The Integrated Lake-Watershed Acidification Study: Proceedings of the ILWAS Annual Review Conference, prepared by Tetra Tech, Inc., for the Electric Power Research Institute, EA-2827, January 1983

5. Katzenstein, Alan W., An Updated Perspective on Acid Rain, Edison Electric Institute, November 1981, p. 12-15

6. Sequeira, R. "Acid Rain: An Assessment Based on Acid-Base Considerations," Journal of Air Pollution Control Association, Vol. 32, 1982, p. 241-245

7. Chameides, William L., and Douglas D. Davis, "Chemistry in the Troposphere," Chem. and Eng. News, Vol. 60, No. 40, October 4, 1982, p. 38-52

8. Retzsch, Walter C., A. G. Everett, Paul F. Duhaime, and R. Nothwanger, Alternative Explanations for Aquatic Ecosystems Effects Attributed to Acidic Precipitation, Everett & Associates, Rockville, Md., March 1982

9. Peters, N., R. Schroeder, and D. Troutman, *Temporal Trends in the Acidity of Precipitation and Surface Waters of New York*, U. S. Geological Survey, Water Supply Paper 2188, 1982

10. Whitehead, D. R., et al, "Late Glacial and Postglacial pH Changes in Adirondack Lakes," *Bulletin of the Ecological Society of America*, Vol. 62, 1981, p. 154

11. United States - Canada Memorandum of Interest on Transboundary Air Pollution, *Impact Assessment*, Work Group I, February 1983

12. *Effects of SO_2 and Its Derivatives on Health and Ecology, Volume 2, Natural Ecosystems, Agriculture, Forestry and Fisheries*, International Electric Research Exchange, represented by Electric Power Research Institute, Canadian Electrical Association, Japan IERE Council, and International Union of Producers and Distributors of Electrical Energy, November 1981

13. *National Acid Precipitation Assessment Plan*, prepared by Interagency Task Force on Acid Precipitation, June 1982

14. Samson, P. J., *On the Linearity of Sulfur Dioxide to Sulfate Conversion in Regional Scale Models*, report to Office of Technology Assessment, 1982

15. *A Detailed Analysis of the Scientific Evidence Concerning Acidic Deposition*, Comments of the American Petroleum Institute, EPA Docket No. ECAO-DC-79-1, Acidic Deposition Index, 1981

16. Tyree, S. Y., Jr., "Rainwater Acidity Measurement Problems, *Atmos. Environ.*, Vol. 5, 1981, p. 57-60

17. Husar, R. B., *On Acid Deposition and Possible Remedies*, Washington University, St. Louis, MO, 1983

18. Fay, J. A., D. Golomb, and James Gruhl, *Controlling Acid Rain*, Report No. MIT-EL 83-004, MIT Energy Laboratory, Cambridge, MA, April 1983

19. UAPSP Precipitation Data Displays for January 1, 1979 - June 30, 1982, Vol. 1 and 2, Interim Report, August 1983, prepared by Electric Power Research Institute and Rockwell International for the Utility Acid Precipitation Study Program.

20. A Report on the Results from the Edison Electric Institute Study of the Impacts of the Senate Committee on Environment and Public Works Bill on Acid Rain Legislation (S.768), National Economic Research Associates, Inc., June 1983

21. The Regional Implications of the Transported Air Pollutants: An Assessment of Acidic Deposition and Ozone, interim draft, Office of Technology Assessment, 1982

FIGURE 1

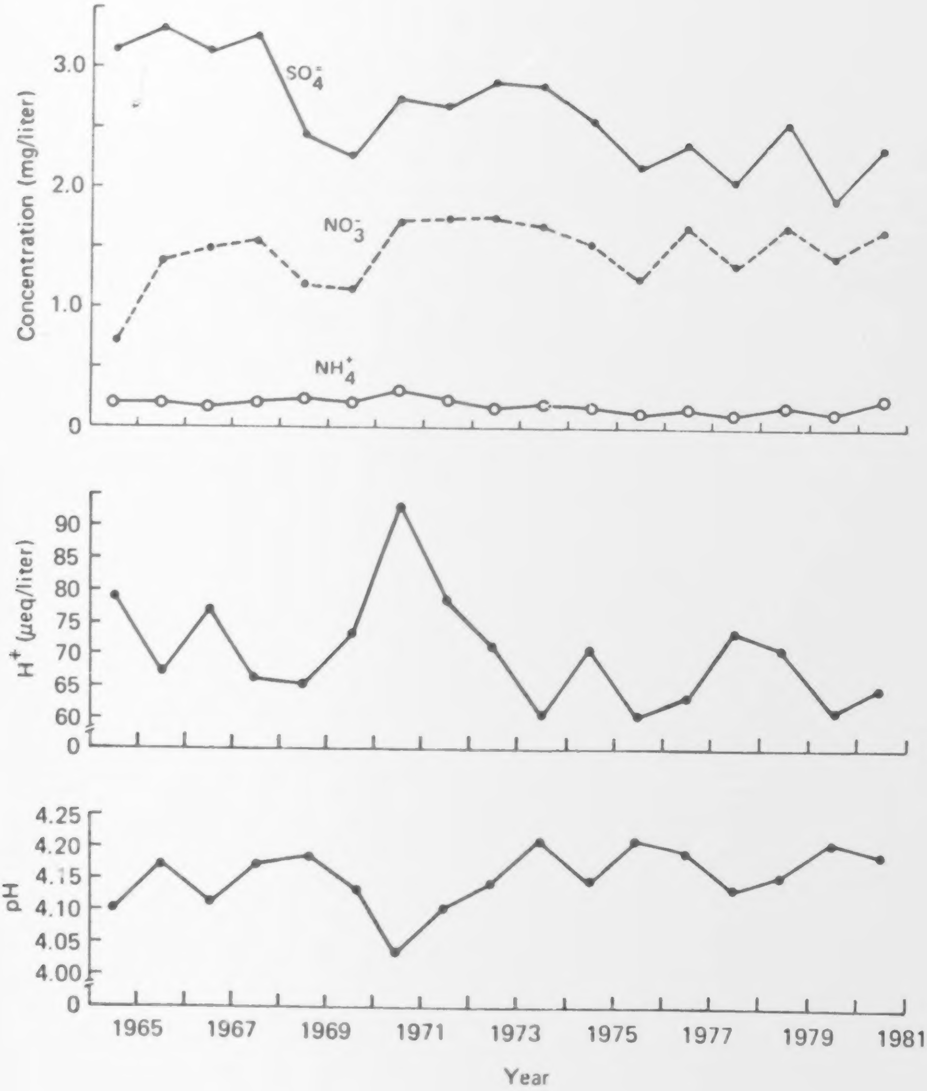
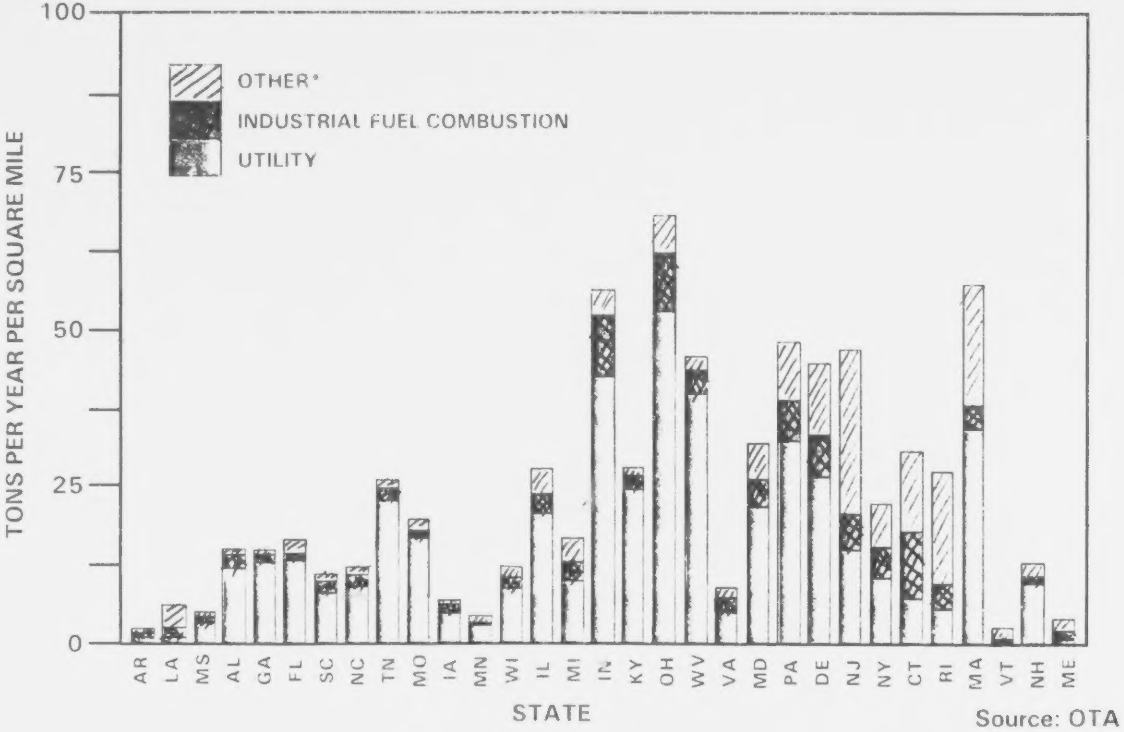

$SO_4^=$
NO_3^-
NH_4^+
Concentration (mg/liter)
3.0
2.0
1.0
0
H$^+$ (μeq/liter)
90
85
80
75
70
65
60
0
pH
4.25
4.20
4.15
4.10
4.05
4.00
0
1965
1967
1969
1971
1973
1975
1977
1979
1981
Year

FIGURE 2

1980 SO_2 EMISSION DENSITY FOR STATIONARY SOURCES IN THE EASTERN U.S.
(All states east of Mississippi River plus AR, IA, LA, MN, and MO)



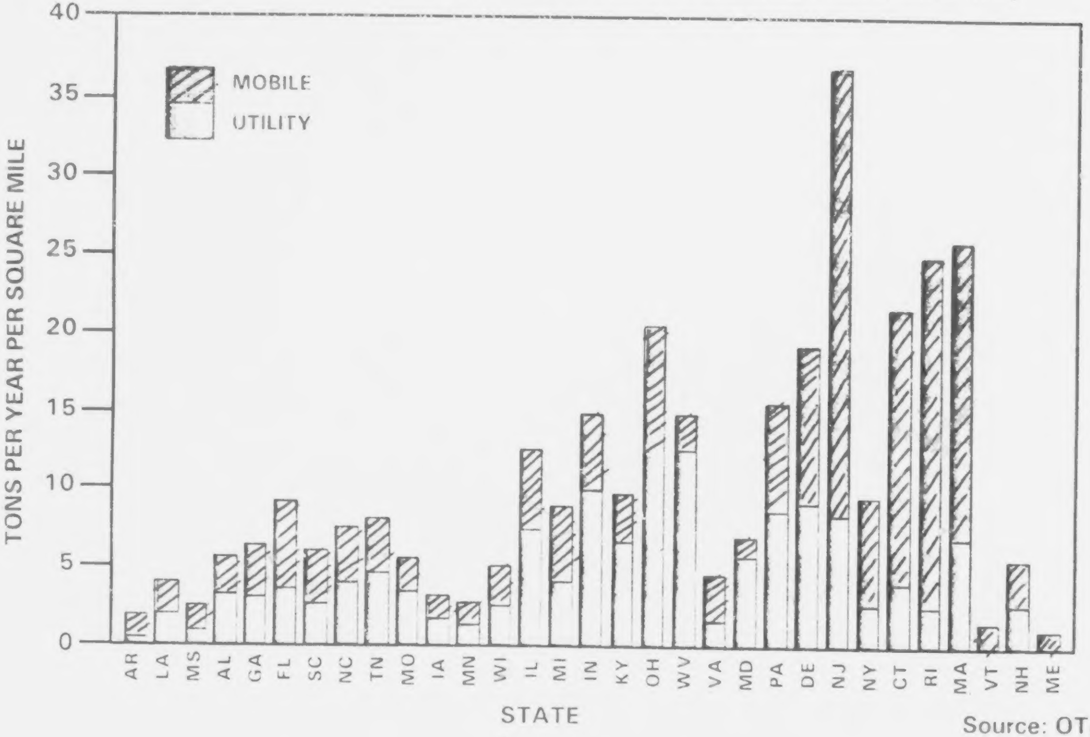
Source: OTA

*Residential, commercial, industrial process, refinery, smelter, incinerator, etc.

FIGURE 3

1980 NO$_x$ EMISSION DENSITY FOR UTILITY AND MOBILE SOURCES IN THE EASTERN U.S.

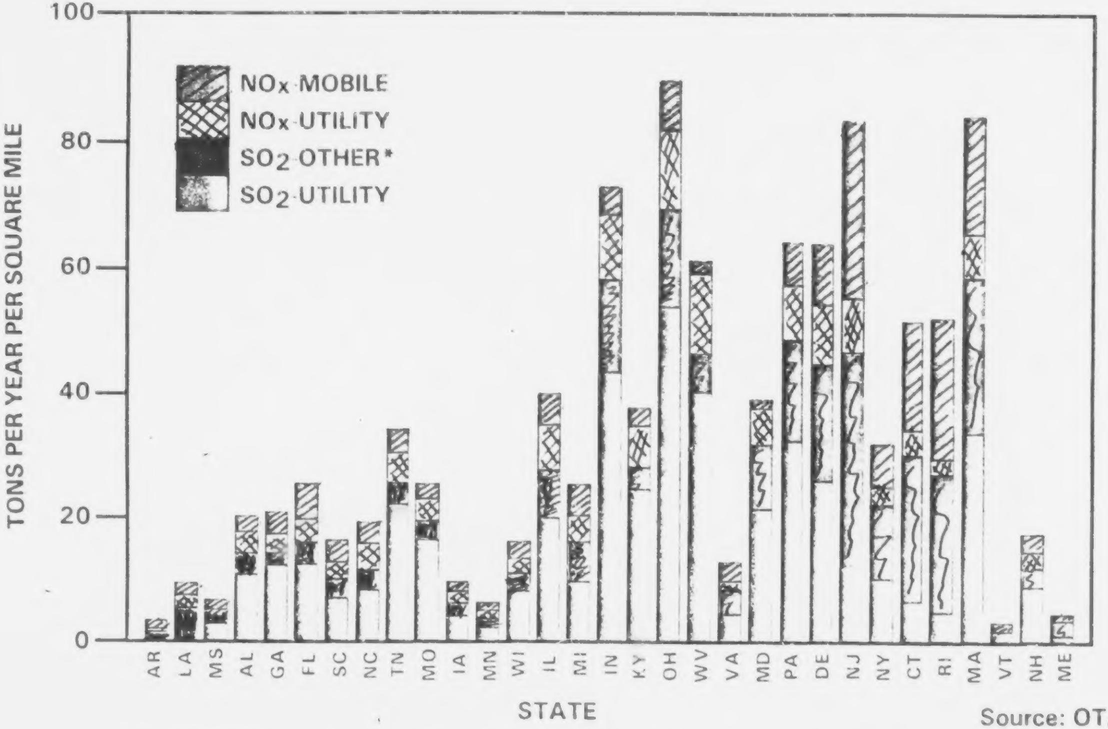
(All states east of Mississippi River plus AR, IA, LA, MN, and MO)



Source: OTA

FIGURE 4

1980 SO_2 AND NO_x EMISSION DENSITY IN THE EASTERN STATES (All states east of the Mississippi River plus AR, IA, LA, MN, and MO)



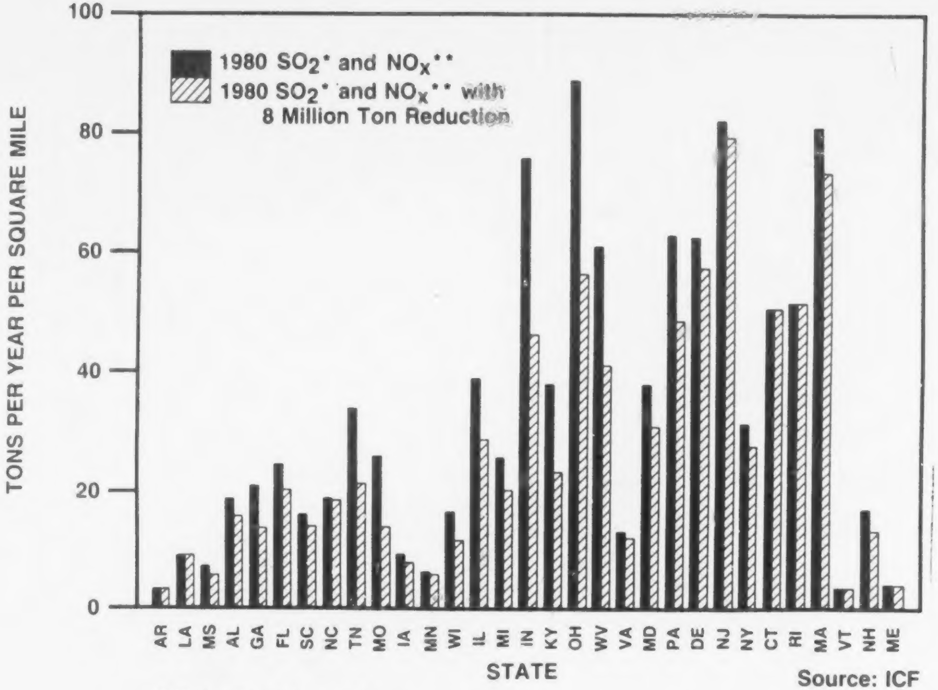
Source: OTA

*Residential, commercial, industrial process, refinery, smelter, incinerator, etc.

FIGURE 5

1980 SO_2 AND NO_x EMISSION DENSITY IN THE EASTERN STATES S.768 EVALUATION

(All states east of the Mississippi River plus, AR, IA, LA, MN, and MO)



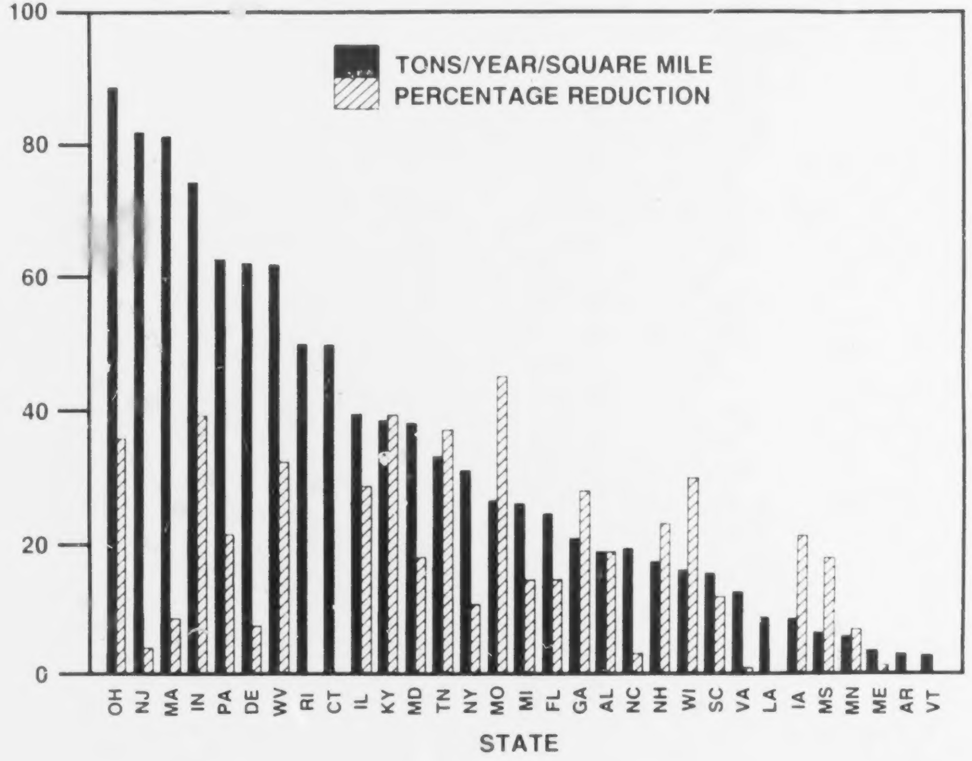
Source: ICF

*Utility and other SO_2 sources

**Utility and mobile NO_x sources only

FIGURE 6

TOTAL SO_2 AND NO_x EMISSION DENSITY IN THE ARMS REGION



Southern Company Services, Inc.
800 Shades Creek Parkway
Post Office Box 2625
Birmingham, Alabama 35202
Telephone 205-870-6316

William B. Harrison
Senior Vice President

Southern Company Services
the southern electric system

February 20, 1984

The Honorable George J. Mitchell
Committee on Environment and Public Works
United States Senate
Washington, D. C. 20510

Dear Senator Mitchell:

At the hearing on February 9, you asked me to provide supporting information on projected costs for the Southern electric system if S.768 were enacted, and also about future projections of SO_2 emissions from existing coal-fired power plants.

On both subjects, I enclose information currently available from our files, but if you desire more information or further elaboration on any aspect of my enclosures, I hope you will give me the opportunity to comply.

Attachment A is a brief description of the methodology and key assumptions used in making the estimates of the financial impact of S.768 on the Southern electric system, and Attachment B displays the actual figures used and results of the calculations. As I stated on February 9, the same methodology should be expected to develop different results for different utility systems, depending on the current and projected dependence on coal-fired relative to other facilities, the extent of emission control in place in the base year, and the anticipated demand growth in different systems.

Attachment C is a paper by one of my associates dealing with the importance of consistent and appropriate methods of estimating costs so as to eliminate some of the apparent discrepancies among estimates by reputable parties and so as to enable comparisons of results based on differing assumptions.*

On the matter of future projections of SO_2 emissions, I have excerpted a number of pages from an ICF report prepared for the Office of Policy Analysis of the EPA. Attachment D* is the title page to facilitate retrieval by your staff. Attachment E is a graphic display of the drop in emissions from existing utility plants after the year 2000. The actual numbers plotted on Attachment E are found in Tables A-1, A-6, B-1, C-1, and C-7 which are bound together as Attachment F. Please note that the emissions from existing plants in the 31-Eastern states are expected to be reduced from 16.19 million tons of SO_2 in 1980 to 9.98 in the year 2010. It is very important to consider the assumptions made in developing these estimates, and they are discussed in Attachment G.* "Caveats and Uncertainties" are discussed in Attachment H.* Of special significance is the assumption that the useful life for all existing coal and oil/gas steam plants has been assumed to be 45 years. If significant numbers of plants are retired at ages less than 45 years, the emission reductions achieved by 2010 will be larger than estimated.

---

*Retained in committee files.

I sincerely appreciate your request for more information and I trust that my enclosures are responsive to your wishes. Please call on me if I can be of further use to you or the Committee on Environment and Public Works regarding these matters.

Very truly yours,

W B Harrison

William B. Harrison

mc

Enclosures

cc: Senator Robert T. Stafford w/enc.

---

*Retained in committee files.

Attachment A

IMPACT OF S.768 ON THE SOUTHERN COMPANY

The attached sheet shows the projected costs to The Southern Company of complying with S.768. Also shown are the principal inputs and assumptions used in the calculations.

The analysis was based on a unit by unit comparison of the costs of fuel switching (to a 0.7 percent sulfur coal) versus retrofitting of a scrubber. The lowest cost options were selected that still allowed the total reduction requirement to be met. The costs for scrubbing were based on the September 1981 Radian Corporation report prepared for EPA entitled "Flue Gas Desulfurization Cost Estimates for Acid Rain Studies." Premiums for low sulfur coal were calculated based on projections from high and low sulfur coal contracts which the company currently has in force.

Some important conservative assumptions were included in the analysis. No contingency was included to allow a "safety margin" for such possibilities as a low hydroelectric generation year or a lengthy unexpected outage at a nuclear plant. Neither was an allowance made for the possible need to offset increases in industrial emissions. While almost 600 MW of generating capacity would be "lost" due to the installation of scrubbers, it was not assumed that these would be replaced immediately with new plants. Instead, an imputed capacity rental cost was used.

The results of this analysis show an increase in first year revenue requirements of over $1 billion in 1982 dollars. This would be almost a 14 percent rate increase in 1993 over current rates on a per kWh basis (with both expressed in 1982 dollars). Please note that the per household cost is total increase in revenue requirements divided by projected households in the service territory in 1993.

me:0056i

Attachment B

1993 IMPACT OF S.768 ON THE SOUTHERN COMPANY

BASE CASE 1993 SO_2 EMISSIONS (TONS): 1,638,000

SHARE OF 8 MILLION TON REDUCTION: 534,700

TOTAL REQUIRED SO_2 REDUCTIONS IN 1993 (TONS): 961,000

REDUCTION STRATEGY
MW SCRUBBED: 9740
MW FUEL SWITCHING: 1906

MW RETIRED: 0

SO_2 EMISSION REDUCTIONS DUE TO SCRUBBING (TONS): 800,500

SO_2 EMISSION REDUCTIONS DUE TO FUEL SWITCHING (TONS): 156,500

NET SO_2 EMISSION REDUCTIONS DUE TO RETIREMENTS (TONS): 0

COST DETAILS
SCRUBBER CAPITAL COST (1982 $/kW): 197-337
FIXED SCRUBBER O&M (1982 $/kW YEAR): 1.1

VARIABLE SCRUBBER O&M (1982 MILLS/kWH): 1.4

PREMIUM FOR LOW S VS. HIGH S COAL (1982 $/TON): 22.50 (average)

MW LOST DUE TO SCRUBBER: 582

MW LOST DUE TO FUEL SWITCHING: 0

CAPACITY REPLACEMENT RENTAL COST (1982 $/kW YEAR): 95

FORCED OUTAGE RATE PENALTY DUE TO ADDING FGD: 5%

NOMINAL WEIGHTED COST OF CAPITAL: 14.34%

ASSUMED INFLATION RATE: 7%

ANNUAL FIXED CHARGE RATE FOR FGD (FIRST YEAR): 24.8%

REAL LEVELIZED FIXED CHARGE RATE (FIRST FIVE YEARS): 18.1%

COST OF SO_2 REDUCTIONS
TOTAL CAPITAL COST (1982 $): 2,657,600,000*
FIRST YEAR REVENUE REQUIREMENT (1982 $): 1,025,600,000

FIRST FIVE YEARS REAL LEVELIZED REVENUE REQUIREMENT (1982 $): 847,500,000

FIRST YEAR PERCENTAGE RATE INCREASE: 13.6%

FIRST FIVE YEARS PERCENTGE RATE INCREASE: 11.3%

FIRST YEAR PER HOUSEHOLD COST (1982 $): 224

FIRST FIVE YEARS LEVELIZED ANNUAL HOUSEHOLD COST (1982 $): 185

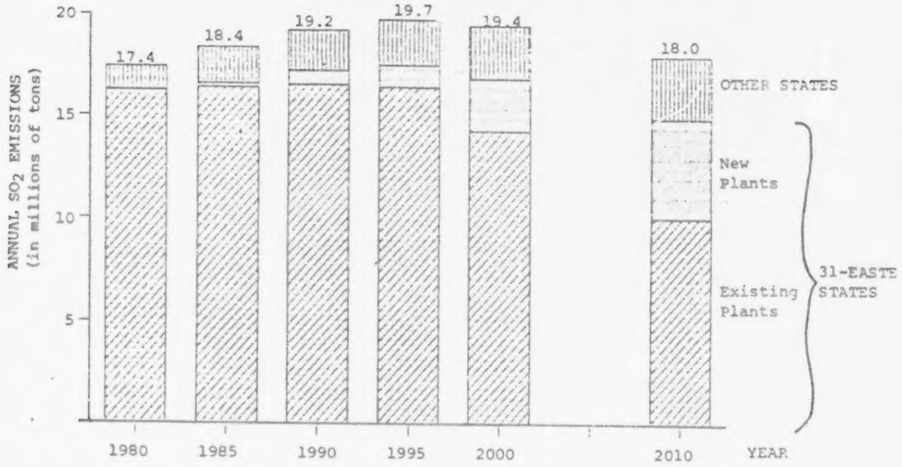
*Does not include replacement capacity.

Attachment E

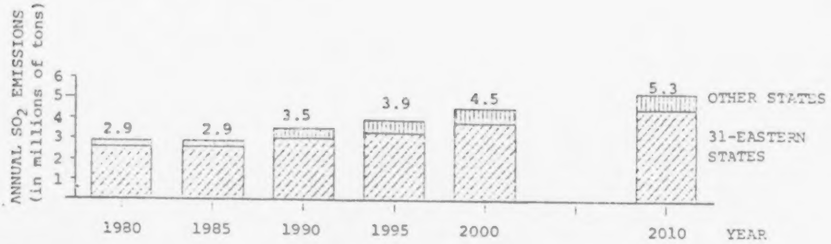
S-2

FORECASTED NATIONAL SO_2 EMISSIONS

UTILITY POWERPLANTS



INDUSTRIAL FACILITIES



ICF INCORPORATED

Attachment F

TABLE A-1

EMISSION FORECASTS -- 1985

	1980	Base 1985	Changes from Base -- Senate Bill Intrastate Trading 1985
Utility SO_2 Emissions			
(millions of tons)			
31-Eastern-States			
Existing			
Coal	14.92	15.35	-1.47
Oil/Gas	1.27	1.03	-0.15
	16.19	16.38	-1.62
New	-	0.26	+0.03
Total 31-Eastern States	16.19	16.64	-1.59
Other	1.19	1.74	-
Total U.S.	17.38	18.38	-1.59
Industrial SO_2 Emissions			
(millions of tons)			
31-Eastern States	2.60	2.55	-
Other	0.32	0.36	-
Total U.S.	2.92	2.91	-
Utility and Industrial SO_2 Emissions			
(millions of tons)			
31-Eastern States	18.79	19.19	-1.59
Other	1.51	2.10	-
Total U.S.	20.30	21.29	-1.59

TABLE A-6

EMISSION FORECASTS -- 1990

	1980	Base 1990	Changes from Base -- Senate Bill Intrastate Trading 1990
Utility SO_2 Emissions (millions of tons)			
31-Eastern-States			
Existing			
Coal	14.92	15.68	-1.59
Oil/Gas	1.27	0.80	-0.11
	16.19	16.48	-1.70
New	-	0.71	+0.07
Total 31-Eastern States	16.19	17.19	-1.63
Other	1.19	2.05	-
Total U.S.	17.38	19.24	-1.63
Industrial SO_2 Emissions (millions of tons)			
31-Eastern States	2.60	3.00	-
Other	0.32	0.48	-
Total U.S.	2.92	3.48	-
Utility and Industrial SO_2 Emissions (millions of tons)			
31-Eastern States	18.79	20.19	-1.63
Other	1.51	2.53	-
Total U.S.	20.30	22.72	-1.63

ICF INCORPORATED

TABLE B-1

EMISSION FORECASTS -- 1995

			Changes from Base -- Senate Bill		
	1980	Base 1995	Intrastate Trading 1995	Interstate Trading 1995	Emission Cap 1995
Utility SO_2 Emissions (millions of tons)					
31-Eastern-States					
Existing					
Coal	14.92	15.51	-8.55	-8.53	-8.76
Oil/Gas	1.27	0.90	-0.48	-0.50	-0.47
	16.19	16.41	-9.03	-9.03	-9.23
New	-	1.06	-0.05	-0.05	+0.05
Total 31-Eastern States	16.19	17.47	-9.08	-9.08	-9.18
Other	1.19	2.21	+0.04	+0.04	+0.02
Total U.S.	17.38	19.68	-9.04	-9.04	-9.16
Industrial SO_2 Emissions (millions of tons)					
31-Eastern States	2.60	3.32	-0.39	-0.39	-0.39
Other	0.32	0.58	-	-	-
Total U.S.	2.92	3.90	-0.39	-0.39	-0.39
Utility and Industrial SO_2 Emissions (millions of tons)					
31-Eastern States	18.79	20.79	-9.47	-9.47	-9.57
Other	1.51	2.79	+0.04	+0.04	+0.02
Total U.S.	20.30	23.58	-9.43	-9.43	-9.55

TABLE C-1

EMISSION FORECASTS -- 2000

			Changes from Base -- Senate Bill		
	1980	Base 2000	Intrastate Trading 2000	Interstate Trading 2000	Emission Cap 2000
Utility SO$_2$ Emissions					
(millions of tons)					
31-Eastern-States					
Existing					
Coal	14.92	13.74	-7.53	-7.61	-7.90
Oil/Gas	1.27	0.49	-0.23	-0.28	-0.26
	16.19	14.23	-7.76	-7.89	-8.16
New	-	2.61	-0.25	-0.17	-0.65
Total 31-Eastern States	16.19	16.84	-8.01	-8.06	-8.81
Other	1.19	2.52	+0.11	+0.12	+0.06
Total U.S.	17.38	19.36	-7.90	-7.94	-8.75
Industrial SO$_2$ Emissions					
(millions of tons)					
31-Eastern States	2.60	3.80	-0.73	-0.73	-0.73
Other	0.32	0.73	-	-	-
Total U.S.	2.92	4.53	-0.73	-0.73	-0.73
Utility and Industrial SO$_2$ Emissions					
(millions of tons)					
31-Eastern States	18.79	20.64	-8.74	-8.79	-9.54
Other	1.51	3.25	+0.11	+0.12	+0.06
Total U.S.	20.30	23.89	-8.63	-8.67	-9.48

TABLE C-7

EMISSION FORECASTS -- 2010

			Changes from Base -- Senate Bill		
	1980	Base 2010	Intrastate Trading 2010	Interstate Trading 2010	Emission Cap 2010
Utility SO_2 Emissions (millions of tons)					
31-Eastern-States					
Existing					
Coal	14.92	9.73	-5.09	-5.40	-5.86
Oil/Gas	1.27	0.25	-0.11	-0.11	-0.13
	16.19	9.98	-5.20	-5.51	-5.99
New	-	4.94	-0.44	-0.20	-1.68
Total 31-Eastern States	16.19	14.92	-5.64	-5.71	-7.67
Other	1.19	3.08	+0.05	+0.07	+0.02
Total U.S.	17.38	18.00	-5.59	-5.64	-7.65
Industrial SO_2 Emissions (millions of tons)					
31-Eastern States	2.60	4.46	-1.0	-1.0	-1.0
Other	0.32	0.86	-	-	-
Total U.S.	2.92	5.32	-1.0	-1.0	-1.0
Utility and Industrial SO_2 Emissions (millions of tons)					
31-Eastern States	18.79	19.38	-6.64	-6.71	-8.67
Other	1.51	3.94	+0.05	+0.07	+0.02
Total U.S.	20.30	23.32	-6.59	-6.64	-8.65

Southern Company Services, Inc.
800 Shades Creek Parkway
Post Office Box 2625
Birmingham, Alabama 35202
Telephone 205-870-6316

William B. Harrison
Senior Vice President

Southern Company Services
the southern electric system

February 20, 1984

The Honorable Robert T. Stafford
Committee on Environment and Public Works
United States Senate
Washington, D. C. 20510

Dear Senator Stafford:

At the hearing on February 9, you asked me to provide additional information on the extent to which scrubber systems have been installed and the degree to which switching from higher to lower sulfur coal has been implemented as SO_2 emission reduction strategies in the electric utility industry.

On the subject of scrubber systems, I enclose Attachment I, a map of the United States showing the locations of 111 operating scrubbers, 51 scrubbers under construction, and 57 scrubbers currently planned. Attachment II provides details concerning each company, each unit, and each state on which the map information is based.

In response to the question about fuel switching, I enclose Attachment III,* a draft memorandum prepared by ICF for EPA (Schweers and McCallister to Brenner and Austin, July 8, 1982). The objective of the memorandum is to estimate costs of fuel switching, rather than the amount of fuel switching which had occurred, but the study is relevant to your question. Your attention is directed to Table 1, p. 5, which summarizes the results for 1980. Please note that approximately 30 percent of the coal consumed in 1980 was estimated to represent a "lower sulfur" choice at an incremental cost increase of about one billion dollars for that year. I am sure that you understand the uncertainties which accompany such estimates, but I believe the approach by ICF is objective and reasonable. Incidentally, please note that "it is estimated that utilities will pay about 1.5 billion dollars (1980 dollars) in higher annual cost for delivered coal in 1985, as a result of current emission limits."

I appreciate your request for additional information and I hope that these enclosures are directly and completely responsive to your wishes. If you desire other information or if there is some other way in which I may be of service to you or the Committee on Environment and Public Works, please call on me.

Very truly yours,

W B Harrison

mc

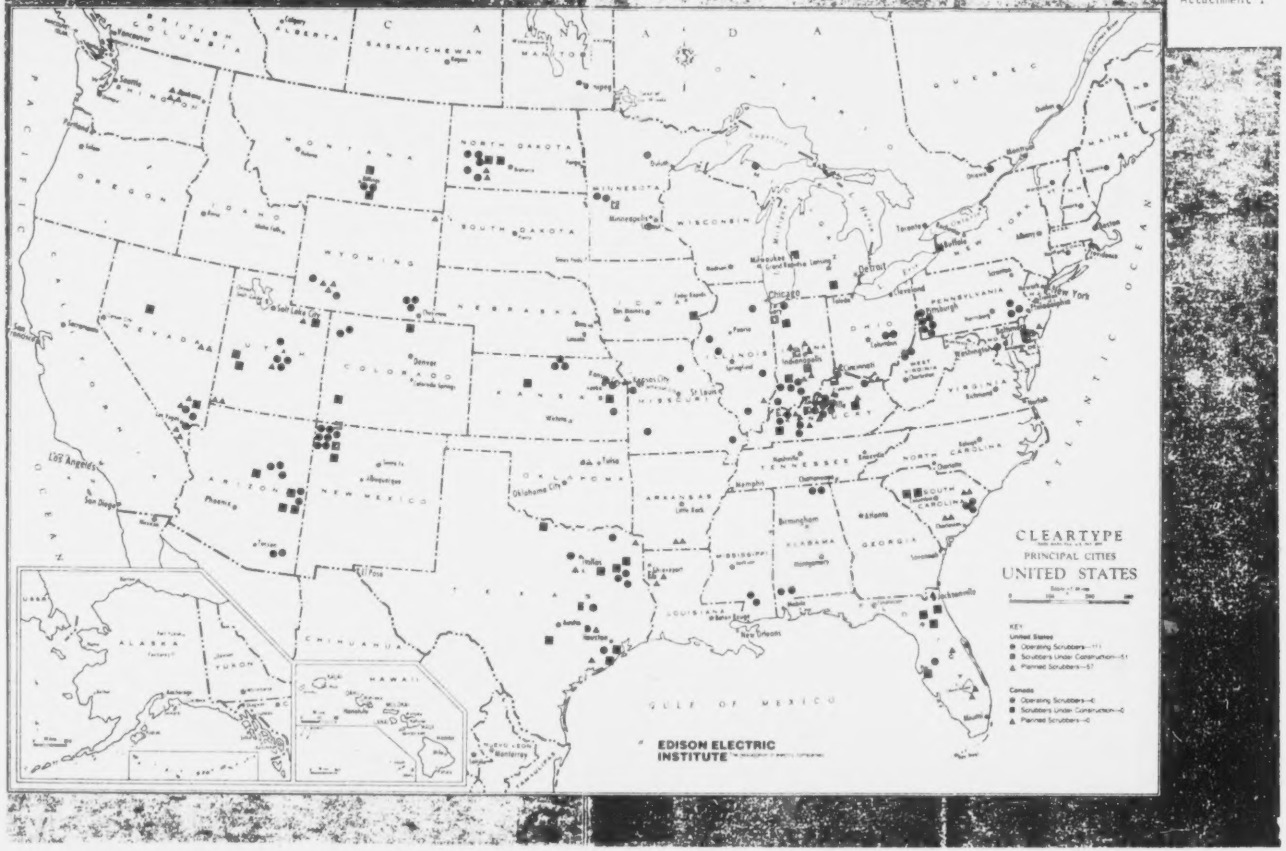
Enclosures

---

*Retained in committee files.

Attachment 1

LOCATION OF FGD SYSTEMS IN NORTH AMERICA
September 1983



Attachment II

September 1983

UTILITY FGD SYSTEMS

Operational

Company	Unit	State
Alabama Electric Coop.	Tombigbee 2	AL
Alabama Electric Coop.	Tombigbee 3	AL
Arizona Electric Power Coop.	Apache 2	AZ
Arizona Electric Power Coop.	Apache 3	AZ
Arizona Public Service Co.	Cholla 1	AZ
Arizona Public Service Co.	Cholla 2	AZ
Arizona Public Service Co.	Cholla 4	AZ
Arizona Public Service Co.	Four Corners 1	NM
Arizona Public Service Co.	Four Corners 2	NM
Arizona Public Service Co.	Four Corners 3	NM
Associated Electric Coop.	Thomas Hill 3	MO
Basin Electric Power Coop.	Laramie River 1	WY
Basin Electric Power Coop.	Laramie River 2	WY
Basin Electric Power Coop.	Laramie River 3	WY
Big Rivers Electric Corp.	Green 1	KY
Big Rivers Electric Corp.	Green 2	KY
Central Illinois Public Service	Newton 1	IL
Central Illinois Light Co.	Duck Creek 1	IL
Cincinnati Gas & Electric Co.	East Bend 2	KY
Colorado Ute. Electric Assn.	Craig 1	CO
Colorado Ute. Electric Assn.	Craig 2	CO
Columbus & Southern Ohio Electric	Conesville 5	OH
Columbus & Southern Ohio Electric	Conesville 6	OH
Commonwealth Edison Co.	Will County 1	IL
Cooperative Power Assn.	Coal Creek 1	ND
Cooperative Power Assn.	Coal Creek 2	ND
Delmarva Power & Light	Delaware City 1	DE
Delmarva Power & Light	Delaware City 2	DE
Delmarva Power & Light	Delaware City 3	DE
Duquesne Light Co.	Elrama 1-4	PA
Duquesne Light Co.	FR Phillips 1-4	PA
East Kentucky Power Coop.	HL Spurlock 2	KY
Hoosier Energy Division	Merom 1	IN
Hoosier Energy Division	Merom 2	IN
Houston Lighting & Power Co.	W. A. Parish 8	TX
Indianapolis Power & Light	Petersburg 3	IN
Kansas City Power & Light	Hawthorn 3	MO
Kansas City Power & Light	Hawthorn 4	MO
Kansas City Power & Light	La Cygne 1	KS
Kansas Power & Light Co.	Jeffrey 1	KS
Kansas Power & Light Co.	Jeffrey 2	KS
Kansas Power & Light Co.	Jeffrey 3	KS
Kansas Power & Light Co.	Lawrence 4	KS
Kansas Power & Light Co.	Lawrence 5	KS
Kentucky Utilities Co.	Green River 1-2	KY
Lakeland Light & Water Dept.	McIntosh 3	FL

UTILITY FGD SYSTEMS

Operational (Continued)

Company	Unit	State
Louisville Gas & Electric Co.	Cane Run 4	KY
Louisville Gas & Electric Co.	Cane Run 5	KY
Louisville Gas & Electric Co.	Cane Run 6	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 1	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 2	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 3	KY
Louisville Gas & Electric Co.	Mill Creek (KY) 4	KY
Louisville Gas & Electric Co.	Paddys Run 6	KY
Marquette Board Light & Power	Shiras 3	MI
Minnesota Power & Light	Clay Boswell 4	MN
Minnkota Power Coop.	Mr. Young 2	ND
Mononganela Power Co.	Pleasants 1	WV
Monongahela Power Co.	Pleasants 2	WV
Montana Dakota Utilities	Coyote 1	ND
Montana Power Co.	Colstrip 1	MT
Montana Power Co.	Colstrip 2	MT
Nevada Power Co.	Reid Gardner 1	NV
Nevada Power Co.	Reid Gardner 2	NV
Nevada Power Co.	Reid Gardner 3	NV
Northern Indiana Public Ser.	Dean H. Mitchell 11	IN
Northern Indiana Public Ser.	R. M. Schahfer 17	IN
Northern States Power Co.	Riverside (MN) 1-2-6	MN
Northern States Power Co.	Sherburne County 1	MN
Northern States Power Co.	Sherburne County 2	MN
Pacific Power & Light Co.	Jim Bridger 4	WY
Pennsylvania Power Co.	Bruce Mansfield 1	PA
Pennsylvania Power Co.	Bruce Mansfield 2	PA
Pennsylvania Power Co.	Bruce Mansfield 3	PA
Philadelphia Electric Co.	Cromby 1	PA
Philadelphia Electric Co.	Eddystone 1	PA
Philadelphia Electric Co.	Eddystone 2	PA
Public Service Co. of Indiana	Gibson 5	IN
Public Service New Mexico	San Juan (NM) 1	NM
Public Service New Mexico	San Juan (NM) 2	NM
Public Service New Mexico	San Juan (NM) 3	NM
Public Service New Mexico	San Juan (NM) 4	NM
Salt River Project	Coronado 1	AZ
Salt River Project	Coronado 2	AZ
San Miguel Electric Coop.	San Miguel 1	TX
Sikeston Bd. of Mun. Util.	Sikeston 1	MO
Southern Mississippi Electric Power	Morrow 1	MS
Southern Mississippi Electric Power	Morrow 2	MS
South Carolina Public Ser.	Winyah 2	SC
South Carolina Public Ser.	Winyah 3	SC
South Carolina Public Ser.	Winyah 4	SC
South Illinois Power Coop.	Marion 4	IL
Southern Indiana Gas and Electric Co.	AB Brown 1	IN

UTILITY FGD SYSTEMS

Operational (Continued)

Company	Unit	State
Springfield Utilities	Southwest 1	MO
Springfield Water, Light & Power	Dallman 3	IL
Tennessee Valley Auth.	Paradise 1	KY
Tennessee Valley Auth.	Widows Creek 7	AL
Tennessee Valley Auth.	Widows Creek 8	AL
Texas Municipal Power	Gibbons Creek 1	TX
Texas Power & Light Co.	Sandow 4	TX
Texas Utilities Gen. Co.	Martin Lake 1	TX
Texas Utilities Gen. Co	Martin Lake 2	TX
Texas Utilities Gen. Co.	Martin Lake 3	TX
Texas Utilities Gen. Co.	Monticello (TX)	TX
United Power Association	Stanton 2	ND
Utah Power & Light Co.	Hunter 1	UT
Utah Power & Light Co.	Hunter 2	UT
Utah Power & Light Co.	Hunter 3	UT
Utah Power & Light Co.	Huntington 1	UT
Utah Power & Light Co.	Naughton 3	WY
West Penn Power	Mitchell 3	PA
	Total	111 FGD Systems

UTILITY FGD SYSTEMS

Under Construction

Company	Unit	State
Arizona Public Service Co.	Four Corners 4	NM
Arizona Public Service Co.	Four Corners 5	NM
Arizona Public Service Co.	Cholla 5	AZ
Basin Electric Power Coop.	Antelope Valley 1	ND
Basin Electric Power Coop	Antelope Valley 2	ND
Big Rivers Electric Corp.	DB Wilson 1	KY
Cincinnati Gas & Electric Co.	East Bend 1	KY
Colorado Ute. Electric Assn.	Craig 3	CO
Deseret Gen. Trans. Coop.	Moon Lake 1	UT
East Kentucky Power Coop.	JK Smith 1	KY
Grand Haven Bd. Light & Power	JB Sims 3	MI
Grand River Dam Authority	Grada 2	OK
Hoosier Energy Division	Merom 1	IN
Houston Lighting & Power	Limestone 1	TX
Houston Lighting & Power	Limestone 2	TX
Indianapolis Power & Light	Petersburg 4	IN
Jacksonville Electric Auth.	St. Johns River 1	FL
Los Angeles Dept. Water and Power	Intermountain 1	UT
Los Angeles Dept. Water and Power	Intermountain 2	UT
Louisville Gas & Electric Co.	Trimble County 1	KY
Louisville Gas & Electric Co.	Trimble County 2	KY
Michigan South Central Power	Michigan Project 1	MI
Montana Power Co.	Colstrip 3	MT
Montana Power Co.	Colstrip 4	MT
Muscatine Power & Water	Muscatine 9	IA
Nevada Power Co.	Reid Gardner 4	NV
New York State Electric & Gas	Somerset (NY) 1	NY
Northern Indiana Public Serv.	RM Schahfer 18	IN
Northern States Power Co.	Sherburne County 3	MN
Plains Electric G&T Coop.	Plains 1	NM
Platte River Power Auth.	Rawhide 1	CO
Salt River Project	Coronado 3	AZ
Seminole Electric Coop.	Seminole (FL) 1	FL
Seminole Electric Coop.	Seminole (FL) 2	FL
Sierra Pacific Power Co.	North Valmy 2	NV
South Carolina Public Ser.	Cross 1	SC
South Carolina Public Ser.	Cross 2	SC
Southern Indiana Gas Electric	AB Brown 2	IN
Southwestern Electric Power Co.	Dolet Hills 1	LA
Southwestern Electric Power Co.	Pirkey 1	TX
Sunflower Electric Coop.	Holcomb 1	KS
Tampa Electric Co.	Big Bend 4	FL
Tennessee Valley Authority	Paradise 2	KY
Texas Mun. Pwr. Agency	Gibbons Creek 1	TX

UTILITY FGD SYSTEMS

Under Construction (Continued)

Company	Unit	State
Texas Utilities Gen. Co.	Forest Grove 1	TX
Texas Utilities Gen. Co.	Martin Lake 4	TX
Texas Utilities Gen. Co.	Twin Oak 1	TX
Texas Utilities Gen. Co.	Twin Oak 2	TX
Tucson Electric Power Co.	Springerville 1	AZ
Tucson Electric Power Co.	Springerville 2	AZ
West Texas Util. Co.	Oklaunion 1	TX
	Total	51 FGD Systems

UTILITY FGD SYSTEMS

Planned

Company	Unit	State
Arkansas Power & Light Co.	Alec 1	AR
Arkansas Power & Light Co.	Alec 2	AR
Atlantic City Electric Co.	Cumberland (NJ) 1	NJ
Basin Electric Power Coop.	Antelope Valley 3	ND
Big Rivers Electric Corp.	DB Wilson 2	KY
Cajun Electric Power Coop.	Cajun Oxbow 1	LA
Central Maine Power Coop.	Sears Island 1	ME
Central Power & Light	Coleto Creek 2	TX
Delmarva Power & Light	Vienna 9	MD
Deseret Gen. Trans. Coop.	Moon Lake 2	UT
East Kentucky Power Coop.	JK Smith 2	KY
Florida Power & Light Co.	Martin 3	FL
Florida Power & Light Co.	Martin 4	FL
Houston Lighting & Power	Marlakoff 1	TX
Houston Lighting & Power	Marlakoff 2	TX
Indianapolis Power & Light	Patriot 1	IN
Indianapolis Power & Light	Patriot 2	IN
Indianapolis Power & Light	Patriot 3	IN
Iowa Electric Light & Power	Guthrie County 1	IA
Jacksonville Electric Auth.	St. Johns River 2	FL
Kentucky Power Co.	Lewis County 1	KY
Kentucky Power Co.	Lewis County 2	KY
Kentucky Utilities Co.	Hancock 1	KY
Kentucky Utilities Co.	Hancock 2	KY
Los Angeles Department of Water and Power	White Pine Power Project 1	NV
Los Angeles Department of Water and Power	White Pine Power Project 2	NV
Louisville Gas & Electric Co.	Trimble County 3	KY
Louisville Gas & Electric Co.	Trimble County 4	KY
Minnesota Power & Light	Oliver County 1	ND
Nevada Power Co.	Harry Allen 1	NV
Nevada Power Co.	Harry Allen 2	NV
Nevada Power Co.	Harry Allen 3	NV
Nevada Power Co.	Harry Allen 4	NV
Nevada Power Co.	Warner Valley 1	UT
Nevada Power Co.	Warner Valley 2	UT
Oklahoma Gas & Electric Co.	Sooner 3	OK
Oklahoma Gas & Electric Co.	Sooner 4	OK
Orlando Util. Comm.	CH Stanton 1	FL
Pacific Power & Light	Jim Bridger 1	WY
Pacific Power & Light	Jim Bridger 2	WY
Pacific Power & Light	Jim Bridger 3	WY
Pacific Power & Light	Wyodak 1	WY
San Miguel Electric Coop.	San Miguel 2	TX

UTILITY FGD SYSTEMS

Planned (Continued)

Company	Unit	State
South Carolina Electric & Gas	Cope 1	SC
South Carolina Electric & Gas	Cope 2	SC
South Carolina Public Serv.	Cross 3	SC
South Carolina Public Serv.	Cross 4	SC
Southern Indiana Gas Electric	AB Brown 3	IN
Southern Indiana Gas Electric	AB Brown 4	IN
Southwestern Electric Power Co.	Dolet Hills 2	LA
Southwestern Electric Power Co.	Walker County 1	TX
Soyland Power Coop.	Soyland 1	IL
Utah Power & Light Co.	Hunter 4	UT
Washington Water Power Co.	Creston 1	WA
Washington Water Power Co.	Creston 2	WA
Washington Water Power Co.	Creston 3	WA
Washington Water Power Co.	Creston 4	WA
	Total	57 FGD Systems

Statement

of

Carl E. Bagge
President
National Coal Association

On Behalf of

National Coal Association

MR. CHAIRMAN, I AM CARL BAGGE, PRESIDENT OF THE NATIONAL COAL ASSOCIATION. NCA REPRESENTS MOST OF THE NATION'S MAJOR COAL PRODUCERS AS WELL AS OTHER COAL-RELATED ORGANIZATIONS. WE ARE GRATEFUL FOR THIS OPPORTUNITY TO EXPRESS THE INDUSTRY'S VIEWS AND OPINIONS ABOUT S. 768

MR. CHAIRMAN, THE COAL INDUSTRY IS UNITED IN ITS OPPOSITION TO THIS LEGISLATION. WE LONG HAVE SUPPORTED CLEAN AIR GOALS, AND THERE'S NO QUESTION THE CLEAN AIR ACT HAS MANY STRENGTHS. YET, THERE REMAINS TOO MANY BURDENSOME REGULATORY AND ADMINISTRATIVE REQUIREMENTS THAT SAP ECONOMIC GROWTH WITHOUT ADDING TO THE PUBLIC'S HEALTH PROTECTION.

IN OUR VIEW, THE REQUIREMENTS PROPOSED IN THE PSD AND VISIBILITY SECTIONS ADD TO THE COMPLEXITY OF THE ACT, AND WE THEREFORE CANNOT SUPPORT THEM OR THE AMENDMENT.

WE ALSO STRONGLY OPPOSE THIS LEGISLATION BECAUSE OF ITS ACID RAIN PROVISION. IT WOULD HEAP HEAVY COSTS ON MILLIONS OF AMERICANS WITHOUT ACHIEVING THE INTENDED ENVIRONMENTAL RESULTS. WHAT'S MORE, IT'S UNNECESSARY DUE TO THE REDUCTION OF SULFUR DIOXIDE EMISSIONS UNDER THE EXISTING CLEAN AIR ACT.

I SHALL EXPAND ON THESE POINTS LATER MR. CHAIRMAN. BUT LET ME TURN TO ANOTHER CONSEQUENCE OF THE ACID RAIN PROVISION THAT SHOULD CONCERN THOSE WHO ARE DEEPLY COMMITTED TO PRESERVING THIS NATION'S SUCCESSFUL AIR QUALITY MANAGEMENT PHILOSOPHY OF THE PAST 13 YEARS.

THE ACID RAIN PROVISION IS INTENDED AS A TECHNICAL AMENDMENT TO ADDRESS A SPECIFIC ENVIRONMENTAL CONCERN. AS THESE HEARINGS POINT UP, THERE IS WIDE DISAGREEMENT ABOUT THE NEED FOR AND THE EFFICACY OF ACID RAIN CONTROLS.

BUT, THERE IS NO DOUBT THAT THIS PROVISION WOULD ALTER FUNDAMENTALLY THE TENETS BY WHICH AIR QUALITY IN THIS COUNTRY HAS BEEN REGULATED AND CARRIED OUT FOR MORE THAN A DECADE. LET ME BRIEFLY EXPLAIN:

CONGRESS WISELY CHOSE TO SET NATIONAL AMBIENT AIR QUALITY STANDARDS TO PROTECT HUMAN HEALTH AND WELFARE, A CONCEPT THAT THE COAL INDUSTRY LONG HAS SUPPORTED.

CONGRESS ALSO GAVE THE STATES A DEGREE OF FLEXIBILITY IN THE REGULATION OF EXISTING SOURCES. THE STATES ARE CHARGED WITH THE RESPONSIBILITY OF LIMITING EMISSIONS FROM EXISTING PLANTS, BECAUSE THEY BEST CAN DECIDE HOW AMBIENT AIR QUALITY STANDARDS CAN BE MET WITHOUT COMPROMISING LOCAL ECONOMIC REQUIREMENTS AND OTHER PRIORITIES.

THIS REINFORCES THE DUAL GOALS OF THE CLEAN AIR ACT: TO PROTECT HUMAN HEALTH AND WELFARE WHILE ALSO PROMOTING AN EXPANDING ECONOMY.

CONGRESS WENT A STEP FARTHER. AFTER 1971, ALL NEW POWER PLANTS HAD TO MEET STRINGENT UNIFORM FEDERAL LIMITS FOR MAXIMUM CONTROL OF EMISSIONS, CALLED NEW SOURCE PERFORMANCE STANDARDS.

UNDER THIS FRAMEWORK, AS OLDER PLANTS ARE RETIRED THEY ARE REPLACED BY NEW, MORE EFFICIENT ONES THAT MEET STRINGENT EMISSION LIMITS.

THEREFORE, WHEN NEW PLANTS ARE BUILT AND OLDER ONES RETIRED, THE NATION'S AIR GETS PROGRESSIVELY CLEANER. IT'S ANOTHER EXAMPLE OF HOW CONGRESS HAS SOUGHT CONSISTENTLY TO PROMOTE AIR QUALITY AND ECONOMIC GROWTH.

BUT THE ACID RAIN PROVISION OF S. 768 SUPERIMPOSES EVEN TIGHTER EMISSION RESTRICTIONS ON THIS WORKABLE FRAMEWORK. IT WOULD FORCE A CUT IN TOTAL SULFUR DIOXIDE LOADINGS EVEN THOUGH THE OVERWHELMING MAJORITY OF COUNTIES AND STATES ARE ALREADY MEETING NATIONAL AMBIENT AIR QUALITY STANDARDS TO PROTECT HUMAN HEALTH AND WELFARE.

THE PRESCRIBED REDUCTION WOULD BE EQUIVALENT TO IMPOSING A FEDERAL EMISSION LIMIT ON EXISTING PLANTS, THUS REMOVING ANY FLEXIBILITY THE STATES NOW HAVE TO MEET AMBIENT AIR QUALITY STANDARDS.

MEANWHILE, THE PROVISION EFFECTIVELY PLACES LARGE SECTIONS OF THE NATION INTO "NON-ATTAINMENT." ALL FUTURE ECONOMIC GROWTH WOULD HAVE TO BE ACHIEVED BY PURCHASING COSTLY "EMISSION OFFSETS." THE DIFFICULTY IN ADDING NEW SOURCES AND THE COSTS WOULD BE COMPOUNDED, BECAUSE THE CHEAPEST "OFFSETS" WOULD HAVE BEEN REMOVED.

THESE HIDDEN CONSEQUENCES--AN INDIRECT FEDERALLY-MANDATED EMISSON LIMIT ON EXISTING PLANTS AND "NON-ATTAINMENT STATUS" FOR LARGE AREAS OF THE COUNTRY--SUBVERT THE VERY INTENT OF THE ACT.

MEMBERS OF THE PUBLIC WORKS AND ENVIRONMENT COMMITTEE MY POINT IS THIS: THIS ACID RAIN PROVISION IS AN "ENVIRONMENTAL NEUTRON BOMB." IT LEAVES THE CLEAN AIR ACT'S STRUCTURE IN PLACE, BUT IT DESTROYS THE ACT'S STRENGTH AND VITALITY BY RENDERING ITS BASIC PURPOSE IRRELEVANT.

IT GIVES THE IMPRESSION OF ATTACKING ACID RAIN, BUT IN REALITY THE PROVISION IS A SUBTLE WAY TO ALTER FUNDAMENTALLY THE ACT'S PURPOSE TO PROMOTE HUMAN HEALTH AND WELFARE WITHOUT DAMAGING ECONOMIC GROWTH.

I SUBMIT, MR. CHAIRMAN, THAT DEALING WITH PERCEPTIONS RATHER THAN REALITIES IS A MALADY THAT HAS PLAGUED THE ACID RAIN ISSUE FROM THE VERY BEGINNING OF THE DEBATE. HERE ARE JUST A FEW OF THE MOST GLARING EXAMPLES:

- THIS LEGISLATION ASSUMES THAT ACID RAIN IS FORMED BY THE LONG-DISTANCE TRANSPORT OF SULFUR DIOXIDE EMISSIONS FROM COAL PLANTS IN THE MIDWEST TO THE NORTHEAST. THE PERCEPTION IS THAT THIS SO-CALLED LONG TRANSPORT THEORY HAS BEEN PROVED, AND IS UNIVERSALLY ACCEPTED.

THE REALITY IS ACID RAIN'S CAUSES AND EFFECTS ARE AMONG THE MOST COMPLEX PHENOMENA TO FACE A HOST OF SCIENTIFIC DISCIPLINES IN YEARS. THE LONG-DISTANT TRANSPORT THEORY IS SIMPLY ONE OF MANY UNDER RESEARCH. I REMIND YOU THAT NOT EVEN THE NATIONAL ACADEMY OF SCIENCES HAS DETERMINED PRECISELY HOW AND TO WHAT EXTENT POLLUTANTS FROM ONE REGION AFFECT OTHERS.

YET, THERE IS GROWING EVIDENCE THAT ACID RAIN FORMATION IS INFLUENCED MORE BY LOCAL, NOT DISTANT SOURCES, AND INVOLVE A HOST OF EMISSIONS BOTH MAN-MADE AND NATURAL.

IF ACID RAIN TURNS OUT TO BE A LOCAL PHENOMENON, THEN THE LOWERING OF SULFUR DIOXIDE EMISSIONS IN OTHER REGIONS WILL HAVE LITTLE, IF ANY, EFFECT ON THE ACIDITY OF RAINFALL IN THE NORTHEAST, WHICH THIS BILL IS INTENDED TO CONFRONT.

- THE PERCEPTION IS THAT ACID RAIN IS THE CAUSE OF WIDESPREAD ECOLOGICAL DAMAGE, AND MAY BE LINKED TO HUMAN HEALTH PROBLEMS.

THE REALITY IS THAT LABORATORY EXPERIMENTS ASSESSING THE EFFECTS OF ACID RAIN ON CROPS AND FORESTS HAVE PRODUCED AMBIGUOUS RESULTS AT BEST, AND NO DIRECT CAUSE AND EFFECT RELATIONSHIP HAS BEEN ESTABLISHED IN THE NATURAL ENVIRONMENT. THERE IS NO CREDIBLE EVIDENCE THAT ACID RAIN IS INVOLVED IN HUMAN HEALTH PROBLEMS.

ACIDIFIED LAKES ARE REAL. THEY AREN'T PERCEPTIONS. YET THERE IS A PERCEPTION THAT THOUSANDS UPON THOUSANDS OF LAKES CAN NO LONGER SUPPORT FISH AND OTHER AQUATIC LIFE.

THE REALITY IS THAT THE ACCORDING TO THE U.S. FISH AND WILDLIFE SERVICE, THERE ARE ABOUT 200 ACIDIFIED LAKES IN THE COUNTRY, ALL OF THEM IN THE NORTHEAST AND SITUATED AT THE HIGHER ELEVATIONS.

WE KNOW THAT MANY LAKES HAVE BEEN ACIDIFIED FOR THOUSANDS OF YEARS. THIS SUGGESTS STRONGLY THAT ACIDIFICATION IS AN EVOLUTIONARY PROCESS. IT MEANS THAT THERE IS TIME FOR MORE STUDY WITHOUT FEAR OF IMPENDING ECOLOGICAL CONSEQUENCES.

- THE PERCEPTION IS THAT ACID RAIN IS INCREASING. THE REALITY IS THAT NO TRENDS IN RAIN ACIDITY ARE EVIDENT BASED ON EXISTING INFORMATION, ALTHOUGH THE LATEST STUDY BY THE U.S. GEOLOGICAL SURVEY CONCLUDES THAT RAINFALL ACIDITY IN THE NORTHEAST IS NOW STABLE.

- THE PERCEPTION IS THAT ACID RAIN IS THE DOMINANT INFLUENCE IN THE ACIDIFICATION OF LAKES, BUT WHAT ARE THE REALITIES? THE AVAILABLE EVIDENCE SUGGESTS THAT ACIDIFICATION OF LAKES IS INFLUENCED MORE BY THE INABILITY OF THE LAKE'S SURROUNDING SOILS TO BUFFER NATURALLY-OCCURRING ACIDS IN THE SOILS AND VEGETATION.

- THE PERCEPTION IS THAT EXISTING CLEAN AIR LAWS ARE INADEQUATE TO LOWER SULFUR DIOXIDE EMISSIONS FROM COAL PLANTS, AND THAT THIS COUNTRY IS SOMEHOW "DRAGGING ITS FEET" IN THE PURSUIT OF AIR QUALITY GOALS.

THE REALITY IS SULFUR DIOXIDE EMISSIONS ARE FALLING STEADILY EVEN AS COAL BURNING CONTINUES TO GO UP. ACCORDING TO EPA, FROM 1972 TO 1982, AMERICA'S SULFUR DIOXIDE EMISSIONS FELL 22 PERCENT FROM 30.4 MILLION TONS TO 22.4 MILLION TONS. MEANWHILE, UTILITY COAL USE WENT UP FROM NEARLY 349 MILLION TONS TO 594 MILLION TONS, OR MORE THAN 40 PERCENT.

WHAT'S MORE, AMERICANS ARE SPENDING ABOUT $14 BILLION EACH YEAR TO CARRY OUT CLEAN AIR LAWS. NO OTHER INDUSTRIAL SOCIETY CAN MATCH THIS KIND OF COMMITMENT.

FINALLY, MR. CHAIRMAN, THIS BILL IS GROSSLY UNFAIR TO MILLIONS OF AMERICANS, WHO ULTIMATELY WOULD HAVE TO BEAR THE BRUNT OF HIGHER ENERGY COSTS. WE CAN ARGUE ABOUT THE TOTAL FIGURES, BUT MOST REPORTS I'VE SEEN IN AND OUT OF GOVERNMENT INDICATE CAPITAL AND OPERATIONAL COSTS OF MORE THAN $100 BILLION.

SUCH PROSPECTIVE INCREASES CANNOT BE RATIONALIZED AS "MODERATE", AS WE'VE HEARD TOO OFTEN. FOR MANY AMERICANS, ESPECIALLY THE POOR AND THE ELDERLY, EVEN THE SMALLEST RISE IN ELECTRIC COSTS ARE TOO MUCH.

THESE ADDITIONAL BILLIONS IN ENERGY COSTS WOULD HIT CONSUMERS WITHOUT ANY ASSURANCE THAT THE HEAVY COSTS WOULD LEAD TO THE INTENDED ENVIRONMENTAL RESULTS. IT'S A $100 BILLION GAMBLE WITH THE CONSUMER'S MONEY WITH THE ODDS HEAVILY WEIGHTED AGAINST SUCCESS.

MR. CHAIRMAN, THE COAL INDUSTRY WANTS THE MYSTERIES OF ACID RAIN'S CAUSES AND EFFECTS UNRAVELLED.

- THAT'S WHY THE PRIVATE SECTOR IS SPENDING SEVERAL HUNDRED MILLION DOLLARS ON ACID RAIN RESEARCH OVER THE NEXT SEVERAL YEARS.

- THAT'S WHY THE COAL INDUSTRY EARLY ON SUPPORTED TITLE 10 OF THE ENERGY SECURITY ACT--A PROVISION SPONSORED BY THE SENIOR SENATOR FROM NEW YORK, PATRICK MOYNIHAN.

- THAT'S WHY WE ARE SUPPORTING STRONGLY S. 454 SPONSORED BY SENATOR ROBERT BYRD.

- THAT'S WHY WE SUPPORT AND APPLAUD PRESIDENT REAGAN, WHO IS PROPOSING DIRECT, EFFECTIVE ACTION TO MITIGATE DAMAGE TO LAKES FROM ACIDIFICATION. THE PRESIDENT'S PLAN MAINTAINS THE INTEGRITY OF THE CLEAN AIR ACT AND AIR QUALITY REGULATIONS WHILE EXPANDING CONSIDERABLY ACID RAIN RESEARCH BY THE FEDERAL GOVERNMENT.

WHY SHOULDN'T SICK LAKES BE HEALED AT REASONABLE COST WITH PROVEN METHODS? WHY SHOULD THESE CRUCIAL MITIGATION EFFORTS CONTINUE TO BE REVILED AS "BAND-AID" SOLUTIONS, IF WE ARE TRULY INTERESTED IN DEALING WITH THE REALITIES AND NOT THE PERCEPTIONS OF ACID RAIN?

THE COAL INDUSTRY IS DEEPLY COMMITTED TO FINDING THE ANSWERS ABOUT ACID RAIN'S CAUSES AND EFFECTS THAT CONFOUND THE BEST SCIENTISTS IN THE WORLD.

LET'S GO AHEAD AND REPAIR THE DAMAGE. BUT LET'S NOT ASK CONSUMERS TO SPEND BILLIONS OF DOLLARS BEFORE WE ARE SURE WE KNOW WHAT'S CAUSING THE DAMAGE. THAT IS BOTH UNWISE AND IMPRUDENT PUBLIC POLICY.

WE SINCERELY HOPE CONGRESS REJECTS THIS COSTLY COURSE, AND URGE THIS COMMITTEE TO OPPOSE THIS LEGISLATION.

THIS CONCLUDES MY TESTIMONY, MR. CHAIRMAN. I WOULD BE PLEASED TO ANSWER ANY QUESTIONS.

February 9, 1984

Mr. Carl Bagge
President
National Coal Association
1130 17th Street, N.W.
Washington, D.C. 20036

Dear Mr. Bagge:

As a follow-up to your testimony before the Committee on Environment and Public Works on February 9, 1984.I would appreciate your response to the enclosed questions.

1. On page 8 of your statement you cite reports indicating that implementation of the acid rain provisions of S.768 would cost more than $100 billion. Could you identify these reports and describe the assumptions on which such estimates are based, including the period of years over which the costs are aggregated?

2. Your statement does not mention specific employment impact in the coal mining industry, although one of your members, Peabody Coal Company, presented its analysis to the Committee in October, 1981. The analysis showed a substantial decrease in mining employment. Do you endorse the Peabody analysis; do you have any additional analyses of employment impacts which you could supply to the Committee?

The Alliance for Clean Energy has had an analysis of employment impacts done for it by ICF, Inc. This study is a part of the Committee hearing record. Do you agree with the conclusions of this analysis with respect to employment in the coal mining industry?

3. Could you please supply for the record a list of your membership and indicate what kinds of coal each company mines?

Thank you.

Sincerely,

George J. Mitchell
United States Senator

NATIONAL
COAL
ASSOCIATION

COAL

CARL E. BAGGE
President
(202) 463-2647

The Honorable
George J. Mitchell
United States Senate
Washington, D.C. 20510

March 6, 1984

Dear Senator Mitchell:

First let me express my appreciation for your courtesy and attention during my testimony on February 9 before the Committee on Environment and Public Works. By letter of that date you requested my response to several questions relating to costs, employment and coal production. While I understand your desire to solicit additional information upon which to base your decision, the National Coal Association has not generated any independent information on these issues.

There is one portion of my testimony which needs additional clarification. I indicated that SO_2 emission had decreased by 22 percent during the period when utility consumption of coal went up more than 40 percent. You requested evidence to support the 22 percent assertion. Enclosed is a table from EPA's "National Air Pollutant Emission Estimates 1940-1982." This table based on information provided by EPA's Monitoring ~~and~~ Data Analysis Division shows a 22.4% reduction between 1972 and 1982 as noted in our testimony.

During my testimony on S768 I stated, "This bill is grossly unfair to millions of Americans, who ultimately would bear the brunt of higher energy costs. We can argue about total figures but most reports I have seen in and out of government indicate capital and operational costs of more than $100 billion." In your letter you requested identification of those reports. In response I am enclosing a copy of a report prepared by the U.S. Department of Energy* which evaluates reports from several consultants and places the 30-year nominal costs to be borne principally by midwest states between 70 and 100 billion dollars for a 5 million ton reduction and 200 to 300 billion dollars for a 10 million ton reduction. I wish to emphasize my position that the real issue is not what the exact cost will be, but whether the expenditure will lead to the intended environmental results.

---

*Retained in committee files.

1130 Seventeenth Street, N.W.
Washington, D.C. 20036-4677
(202) 463-2625

Your letter also requested my comments on the Peabody Coal Co. and Alliance for Clean Energy analysis of employment impacts. As I stated above, NCA has undertaken no separate analysis of these impacts and I am unable to respond to your request. I have informed both Peabody Coal Co. and the Alliance for Clean Energy of your request and they may elect to respond independently.

I might add that NCA's opposition to acid rain control legislation is not based on what various studies project the impact to be on employment in the coal industry, but on the weak scientific justification for the legislation and the very substantial and unwarranted cost imposed beyond the coal industry, namely on electric rate payers.

Finally, in response to your request for membership information, please find enclosed a current roster of NCA members. I regret that we do not compile information with respect to the kinds of coal each company produces.

Should you need any additional information, please let me know.

Sincerely,

Carl

Carl E. Bagge

COAL PRODUCING MEMBERS - NATIONAL COAL ASSOCIATION

Alabama By-Products Corporation
American Electric Power Service Corporation
Amherst Coal Company
Anaconda Minerals Company
ANR Coal Company
Arch Mineral Corporation
Ashland Coal, Inc.
Barnes & Tucker Company
Berwind Natural Resources Company
Bethlehem Steel Corporation
Blue Diamond Coal Company
Cannelton Industries, Inc.
Carbon Industries, Inc.
CoalARBED, Inc.
Coastal Corporation
Consolidation Coal Company
Cyprus Coal Company (Amoco)
Diamond Shamrock Corporation
Drummond Coal Company, Inc.
Eastern Associated Coal Corporation
Elk Horn Coal Corporation
Exxon Coal USA, Inc.
Freeman United Coal Mining Company
Getty Oil Company
Grace & Company, W. R.
Industrial Fuels Corporation
Inspiration Coal, Inc.
Island Creek Coal Company
Jim Walter Resources, Inc.
Jno. McCall Coal Company, Inc.
Jones & Laughlin Steel Corporation
Kaiser Steel Corporation
Kerr-McGee Coal Corporation
Majestic Mining, Inc.
Mapco, Inc.
Marietta Coal Company
Massey Coal Company, Inc., A. T.
Midland Coal Company
Milburn/Imperial Colliery
Mobil Coal Producing, Inc.
Morrison-Knudsen Company, Inc.
National Mines Corporation
New River Company
Nicor Mining, Inc.

North American Coal Corporation, The
Oglebay Norton Company
Old Ben Coal Company
Peabody Holding Company, Inc.
Pickands Mather & Company
Pittsburg & Midway Coal Mining Company
Pittston Company, The
Pyro Mining Company
Reading & Bates Coal Company
Rochester & Pittsburgh Coal Company
Ruth Coal Company, L. T.
Sahara Coal Company, Inc.
Shell Mining Company
South-East Coal Company, Inc.
Sunoco Energy Development Company
Transco Coal Company
Upshur Coal Corporation
Usibelli Coal Mine, Inc.
Utah International, Inc.
Valley Camp Coal Company
Westmoreland Coal Company
Westmoreland Resources, Inc.
Wyoming Fuel Company
Youghiogheny & Ohio Coal Company
Zeigler Coal Company

COAL SELLERS (Associates) - NATIONAL COAL ASSOCIATION

BROKERS

A. L. Watson & Co., Inc.
Agip Coal USA, Inc.
Anker Energy Corporation
Calvert Coal, Inc.
Carbomin Coal Sales Co
Clarebon Limited
Coal Trading Corporation
Conticoal
Cory Mann George Corporation
Derby Coal Co.
Foreston Coal International, Inc.
Inter-Mountain Coals, Inc.
John K. Irish & Company, Inc.
Midwest Energy Company
Neris Coal Export Co., Inc.
P & C Bituminous Coal, Inc.
P & O Falcoal, Inc.
Primary Coal, Inc.
Ruhrkohle Trading Corporation
SSM Coal Company, Inc.
Stinnes Coal Company, Inc.
Summers Fuel, Inc.
Thyssen Carbometal Company

PRODUCER/SELLERS

A. T. Massey Coal Sales Co.
Anaconda Minerals Company
Ashland Coal, Inc.
Berwind Coal Sales Co.
Blue Diamond Coal Company
CoalArbed, Inc.
Coastal States Energy Co.
Cyprus Coal (Amoco)
Diamond Shamrock
Drummond Coal Sales, Inc.
Eastern Associated Coal Corporation
General Coal Company (Westmoreland)
Industrial Fuels Corp.
Inspiration Coal
Island Creek Coal
Jim Walter Resources
Mapco, Inc.
North American Coal Corp.
Oglebay Norton Co.
Peabody Development
Pickands Mather & Company
Pittston Coal Sales Corp.
Reading & Bates Coal Company
Sahara Coal
Shell (R & F Coal)
Sunedco Coal Company
United Eastern Coal Sales Corp. (R & P)
Utah International, Inc.
Valley Camp Coal Sales Co.
Youghiogheny & Ohio Coal Co.

EQUIPMENT SUPPLIER MEMBERS (Associates) - NATIONAL COAL ASSOCIATION

Bucyrus-Erie Company
Chicago Bridge & Iron Co.
Cincinnati Mine Machinery Co.
Deister-Concentrator Co., Inc.
Dresser Industries, Inc.
Harnischfeger Corporation
Huwood-Irwin Company
Ingersoll-Rand Company
Jennmar Corporation
Joy Manufacturing Company
Mine Safety Appliances Co.
National Mine Service Co.
Peabody ABC Corporation
Roberts & Schaefer Company
T. J. Gundlach Company
Westinghouse Electric Corporation

RESOURCE DEVELOPER MEMBERS (Associates) - NATIONAL COAL ASSOCIATION

BP Coal North America, Inc.
CDF International
Chevron Resources Co.
Columbia Coal Gasification
Dingess-Rum Coal Company
El Paso Coal Company
Entex Coal Company
Internorth Corporation
Meridian Land & Mineral Co.
Phillips Petroleum Company
Scallop Coal Corporation
Sherwood-Templeton Coal Co., Inc.
Tenneco, Inc.
Texaco, USA
Texas Eastern Transmission

COAL TRANSPORTER MEMBERS (Associates) - NATIONAL COAL ASSOCIATION

Canal Barge Company, Inc.
Consolidated Rail Corporation
International Marine Terminals
M/G Transport Services, Inc.

CONSULTANT MEMBERS (Associates) - NATIONAL COAL ASSOCIATION

Arthur D. Little, Inc.
Babcock & Wilcox Company
Bechtel National, Inc.
Chase Manhattan Bank
Citizens Fidelity Energy Co.
Commercial Testing & Engineering Co.
Dames & Moore
Fluor Corporation
Gates Engineering Company
Gilbert Associates, Inc.
John T. Boyd Company
Norton Hambleton, Inc.
Orbital Engineering, Inc.
Paul Weir Company, Inc.
Peat, Marwick Mitchell & Co.
United Conveyor Corporation
Wheelabrator-Frye, Inc.

EPA-450/4-83-024

National Air Pollutant Emission Estimates, 1940-1982

Monitoring and Data Analysis Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

February 1984

TABLE 1

SUMMARY OF NATIONAL EMISSION ESTIMATES

Units of Measurement	Year	Particulates	Sulfur Oxides	Nitrogen Oxides	Volatile Organics	Carbon Monoxide
Teragrams/Year (10^6 metric tons/year)	1940	22.4	18.1	6.7	17.1	79.8
	1950	24.2	20.4	9.2	19.3	85.3
	1960	20.9	20.1	12.7	21.9	87.9
	1970	18.0	28.4	18.1	25.3	100.2
	1971	16.8	26.9	18.5	24.5	98.6
	1972	15.0	27.6	19.7	24.5	95.7
	1973	13.9	28.9	20.2	24.0	91.6
	1974	12.3	27.0	19.7	22.5	86.5
	1975	10.3	25.7	19.2	21.0	82.4
	1976	9.6	26.3	20.4	22.1	87.2
	1977	9.0	26.3	21.0	21.9	83.0
	1978	8.9	24.6	21.2	22.4	82.3
	1979	9.0	24.6	21.3	21.9	79.5
	1980	8.6	23.3	20.7	20.8	77.6
	1981	8.1	22.5	20.9	19.4	75.3
	1982	7.5	21.4	20.2	18.2	73.6
(10^6 short tons/year)	1940	24.7	20.0	7.4	18.8	88.0
	1950	26.7	22.5	10.1	21.3	94.0
	1960	23.0	22.2	14.0	24.1	96.9
	1970	19.8	31.3	20.0	27.9	110.4
	1971	18.5	29.7	20.4	27.0	108.7
	1972	16.5	30.4	21.7	27.0	105.5
	1973	15.3	31.9	22.3	25.5	101.0
	1974	13.6	29.8	21.7	24.8	95.3
	1975	11.4	28.3	21.2	23.1	90.8
	1976	10.6	29.0	22.5	24.4	96.1
	1977	9.9	29.0	23.1	24.1	91.5
	1978	9.8	27.1	23.4	24.7	90.7
	1979	9.9	27.1	23.5	24.1	87.6
	1980	9.5	25.7	22.8	22.9	85.5
	1981	8.9	24.8	23.0	21.4	83.0
	1982	8.3	23.6	22.3	20.1	81.1
Change 1940-1982		-67%	+18%	+201%	+6%	-8%
Change 1970-1982		-58%	-25%	+12%	-28%	-27%

NATIONAL WILDLIFE FEDERATION
1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

STATEMENT OF BENJAMIN C. DYSART III, PRESIDENT OF THE NATIONAL WILDLIFE FEDERATION AT HEARING ON ACID RAIN CONTROL LEGISLATION BEFORE THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE, FEBRUARY 9, 1984

I. Introduction

Mr. Chairman and Committee Members, My name is Ben Dysart. I am President and Chairman of the Board of the National Wildlife Federation, and appear before you in this capacity to testify on the acid rain control provisions of S. 768, the "Clean Air Act Amendments of 1983." I am accompanied by Ken Kamlet, Director of NWF's Pollution and Toxic Substances Division.

I am familiar with the nuts and bolts of solving environmental problems. I hold three degrees in civil, sanitary, and water resources engineering from Valderbilt and Georgia Tech. I am a professor of Environmental and Water Resources Engineering at Clemson University in South Carolina. For the past 16 years, I have taught water resources management and environmental engineering at the graduate level.

I am past president of the Association of Environmental Engineering Professors, and have served in advisory and consulting roles to various Federal resource-management agencies, including a stint (1979-81) on the U.S. Department of Energy-Southern States Energy Board Environmental Task Force. I have also served as a consultant on technical and policy-level matters to major private-sector water, energy, and other resource development interests. The early years of my professional career were spent in industry with Union Carbide Corp. in charge of engineering design and construction of major facilities. In 1975-76, I served as Science Advisor to the first Assistant Secretary of the Army for Civil Works. This past September, Administrator Bill Ruckelshaus appointed me to EPA's Science Advisory Board and its Environmental Engineering Committee.

At the State level, my activities include membership on and chairmanship of the Environmental Quality Control Advisory Board to the South Carolina Department of Health and Environmental Control (1979-present and 1981-82, respectively).

As you know, Mr. Chairman, the Federation, with over 4 million members and supporters and 51 affiliate organizations, is the Nation's largest conservation organization. At every one of our annual meetings from March 1980 on, the voting delegates of our State affiliates have adopted policy resolutions placing NWF on record as being firmly in support of strong controls on acid rain. There is no legislative issue to which we attach a higher organizational priority.

As this Committee well appreciates -- having as it does jurisdiction over so many of our important environmental laws -- our society continues to be confronted by a bewildering array of serious environmental problems which must be dealt with. The clean-up of uncontrolled hazardous waste sites under the Superfund law and the ongoing management of hazardous wastes under RCRA are but two of the more pressing examples.

The solutions to these problems do not come cheap. But the cost of not solving them, to ourselves, to our children and grandchildren, and to our natural heritage, is too terrible to contemplate.

OMB Director, David Stockman, glibly sets the cost of acid rain controls at $6,000 per pound of fish saved. But what of the tens of thousands of square miles of surface water area and tens of millions of cubic yards of forest growth at risk in the eastern U.S. alone because of acid deposition? Or the 20% of soybean and tobacco yields in jeopardy in areas of heavy acid deposition? And what of the other difficult-to-quantify, but nevertheless very real impacts of acid rain and its precursors on construction materials, monuments, and paint finishes; and indeed on human health?

An acid rain control program is an insurance policy on the future of this country. The Dave Stockmans of the world never consider this in their cost-benefit equations.

If it makes sense for all of us in our daily lives to pay for life insurance, even though there's no pay-out for many years, I think it makes sense to start paying now to forestall potentially catastrophic acid rain impacts, even though some of them might not otherwise reach crisis proportions for many years.

II. THE SENATE BILLS, THE ADMINISTRATION'S STANCE, AND NWF's POSITION

A. The Senate Bills

Four bills which address acid rain have been generated by members of this Committee. Three of the four take the same basic approach of mandating an overall level of SO_2 emissions reduction, ranging from 8 to 12 million tons per year, in the 31 eastern states over a period ranging from 10 to 15 years. The Committee compromise bill, S. 768 (first approved by this Committee in the last Congress), includes an acid rain control provision calling for 8 million tons per year of SO_2 emission reduction over 12 years. The Mitchell bill, S. 145, would require 10 million tons of reduction within 10 years. And the Stafford-Hart bill, S. 769, would require 12 million tons of reduction over 15 years.

The fourth bill, S. 2001, introduced by Senator Durenberger, like the Mitchell bill contemplates 10 million tons of emission reductions within 10 years, but differs from the other Committee bills in two respects. First, it would tax SO_2 emissions to generate control cost funds. Second, it would leave most of the details of administration and implementation to EPA (instead of mandating a specific formula for allocating emission reduction responsibilities).

A Fifth Senate bill, S. 454, has been introduced by Senate Minority Leader Byrd (albeit with the co-sponsorship of Senator Randolph of this Committee). This bill, unlike all the others on the Senate side, contemplates no reductions at all in current SO_2 emissions -- only acceleration of the acid rain research program (and a limited cap to prevent major increases in existing emission levels). Although the research program called for in the Byrd bill does not explicitly preclude a parallel acid rain reduction effort, one can safely assume that those who support the Byrd bill without supporting any of the bills generated in this committee do not favor an acid rain control program (at least, anytime soon).

Fortunately, the research-only approach seems not to enjoy the support of very many Senators (or Congressmen) -- although we do not minimize the influence (and political power) of its supporters. If the pollster Lou Harris is to be believed, Congress, by a nearly 4-to-1, 68-18% majority, wants to legislate stricter SO_2 emission standards for existing power plants. Statement of December 4, 1983, before the Coalition of Northeastern Governors.

B. The Administration's Stance

As the entire country is now well-aware, the President, in his State-of-the-Union address last month, declined to put his Administration in support of an acid rain control program. Instead, the President merely called for an increased budget for acid rain research (coupled with unspecified "action" to restore damaged lakes and promote the development of new technologies).

(No less disappointing, the Democrats, in their response to the State-of-the-Union message, stopped short of taking the

President to task for failing to support meaningful acid rain controls -- despite the fact that every Democratic presidential contender, without exception, has taken a position in support of sizeable SO_2 emission reductions).

Amplifying the Administration's position, EPA Administrator Bill Ruckelshaus testified before this Committee a week ago. Mr. Ruckelshaus emphasized the Administration's view that "more scientific information" is needed "before launching the country on an expensive and potentially divisive [acid rain] control program." [Interestingly, in a speech a few months earlier, Administrator Ruckelshaus pointed out that, "if acid rain controls were cheap, there'd be no dispute about the science."] He pledged that the Administration would "craft and support an appropriate set of measures to solve the acid rain problem," when "the fundamental scientific uncertainties have been reduced."

In short, the Administraton has pegged its lack of support for an acid rain control program to the asserted lack of an adequate scientific data base. As we shall demonstrate later in this statement, however, the weight of prevailing scientific opinion and of numerous authoritative bodies is to the contrary.

C. NWF's Position

The National Wildlife Federation supports the basic approach to acid rain controls of this Committee's bill, S. 768. However, we urge the Committee to adopt the 12 million-ton reduction target of the Stafford-Hart bill, S. 769, and the 10-year time-limit of the Mitchell bill, S. 145. A 10-year program was appropriate in 1981 to protect our resouces from further damage. In 1984 -- 3 years later -- we should be looking for ways to tighten, not extend, that time frame. We also support the inclusion of interim milestones, to ensure that the mandated reductions are not all telescoped into the final few years of the specified time interval.

I'd like now to briefly summarize the technical basis for the 50 percent reduction we advocate in sulfur dioxide emissions in the 31-eastern State region.

Basis for 50 Percent Deposition Reduction Goal

This objective derives from the first National Academy of Sciences report (1981). That report noted that, at current rates of sulfur and nitrogen oxide emissions, the number of acid rain-altered lakes "can be expected to more than double by 1990, and to include larger and deeper lakes" (p. 3). Of presently available options, the report pointed out that "only the control of emissions of sulfur and nitrogen oxides can significantly reduce the rate of deterioration of sensitive freshwater ecosystems" (p. 181). In terms of needed levels of reduction, the report stated that "it is desirable to have precipitation with pH values no lower than 4.6 to 4.7 throughout such areas, the value at which rates of degradation are detectable by current survey methods" and that "this would mean [for the most seriously affected areas, with average precipitation pH of 4.1 to 4.2] a reduction of 50 percent in deposited hydrogen ions." (p. 181)

Additional support for a 50% reduction in sulfate deposition comes from the January 1983 U.S.-Canada "MOI documents" (Final Report of Work Group I, Impact Assessment) and from the June 1982 Stockholm Conference on Acidification of the Environment.

The MOI document concluded that: (1) long-term chemical and/or biological effects have been documented when moderately sensitive regions have received more than 30 kilograms of sulfate per hectare per year in precipitation (p. 1-5); (2) precipitation containing from 20 to 30 kg/ha of sulfate causes changes (including changes in chemistry and loss of fish) in moderately sensitive lakes and rivers (pp. 1-3 - 1-5, 1-11); and (3) when a moderately sensitive environment receives less than 20 kg/ha of sulfate in precipitation each year, no chemical or biological effects have been detected (pp. 1-5, 1-7). The Canadian members of the Work Group concluded from these data that a "target loading" not to exceed 20 kg/ha of sulfate in precipitation each year was necessary to protect moderately sensitive lakes and rivers (p. 1-7). The U.S. members, while accepting the underlying data, would not subscribe to a specific target loading. (Note: a 20 kg/ha deposition rate, which corresponds to about 18 lbs/acre, would require an approximately 50% reduction in current sulfate deposition levels -- e.g., New England currently receives wet sulfate deposition loadings of 17-40 kg/ha.yr.)

The report of the Expert Meetings at the Stockholm Conference concluded, based on data from Sweden, Norway, Canada, and the United States, that acidification has been observed to occur in sensitive areas (i.e., with lake alkalinity of less than or equal to 50 ueq/l) receiving 0.5-3 grams of sulfur per square meter per year, but not at 0.5 gram of sulfur per square meter per year. This compares with the present European average of sulfate wet deposition of about 1 g sulfur per m^2 per year, and a total sulfur load in southern Scandinavia and eastern North America of 1.5-3 g sulfur per m^2 per year. An atmospheric sulfur loading of 0.5 g sulfur per m^2 per year coincides with a pH of about 4.7 in wet deposition in Sweden, Norway and eastern Canada. (Paragraphs 9, 27, 48, 53-55.). This again suggests the need for a 50% reduction in deposition.

Basis for 50 Percent Emission Reduction Goal

The 1983 National Academy report (Acid Deposition: Atmospheric Processes in Eastern North America) concluded that, all else being equal, "the annual average concentration of sulfate in precipitation at a given site should be reduced in proportion to a reduction in SO_2 and sulfate transported to that site from a source or region of sources" (p. 10), and that "we would expect that if the molar ratio in emissions in eastern North America were changed by changing SO_2 emissions, a similar change would occur in the ratio of sulfate to nitrate in wet deposition [the same could be said for total -- wet plus dry -- deposition -- if, as stated in the report, "dry deposition is linearly proportional to emissions"] (id.). The report concluded, based upon 3 primary lines of data, that "there is no evidence for a strong nonlinearity in the relationships between long-term average emissions and deposition" (p. 7). The 3 lines of support for this conclusion are: (1) no evidence of strong nonlinearity of data from 13 years of weekly bulk samples at the Hubbard Brook site; (2) data from the midwestern and northeastern U.S. indicate that the percentage of emitted SO_2 that is deposited as sulfate in precipitation is approximately equal to the percentage of emitted NO_x deposited as wet nitrate in that region (since the conversion of NO_2 to nitric acid and its incorporation into cloud water are believed to be relatively rapid and efficient, there is no basis for the view that the conversion of SO_2 to sulfate is any less rapid or complete); and (3) theoretical calculations taking account of the latest results of realistic laboratory studies (i.e., when previously utilized models are adjusted to more correctly represent the gas-phase reactions leading to the oxidation of SO_2 -- viz., without net consumption of a major oxidant, the hydroxy radical -- the apparent nonlinearity in the relationship between changes in ambient concentrations of SO_2 and changes in ambient concentrations of sulfate aerosol is greatly reduced).

The important caveats associated with the report are:

1. Although "all sources in eastern North America must be considered as contributing in one degree or another to the

phenomenon of acid deposition...," the "relative contributions of specific source regions to specific receptor sites currently remain unknown" (p. 5).

2. The "relative importance for deposition at specific sites of long-range transport from distant sources as compared with more direct influences of local sources cannot be determined from currently available data... or reliably estimated using currently available models" (p. 9).

3. "It can be stated as a rule of thumb that the farther a source is from a given receptor site, the smaller its influence on that site will be per unit mass emitted." (p. 10).

4. "We cannot objectively predict the consequences for deposition in ecologically sensitive areas of changing the spatial pattern of emissions in eastern North America, such as by reducing emissions in one area by a larger percentage than in other areas" (p. 11).

5. The necessary data and theoretical understanding to model the effects of emissions from distant sources on the composition of precipitation reliably and accurately will not be available in the near future. "A significant reduction in the uncertainties related to natural variability, measurement imprecision, or establishment of emissions rates is unlikely in the near future." (p. 138).

6. Useful information about the delivery of acids to ecologically sensitive areas by transport and transformation processes can be determined more quickly by direct empirical observation in the field than by other means. Although the

results of such field studies may not yield complete detailed descriptions of the interactions of all the processes involved, the studies are likely to provide basic phenomenological evidence with sufficient reliability to form a basis for improving the near-term strategy for dealing with the problem of acid deposition in eastern North American. (p. 11).

Basis for 31-State Control Region

The rationale for the 31-state region approach of the various bills under consideration by this Committee is that sources throughout this region contribute acid-forming pollutants to a common pool within the region, that most sensitive areas in the U.S. are within this region, and that the potential for acid rain damage is therefore greatest within this region.

The EPA acid rain task force reportedly considered a control region confined to only 21 U.S. states (but including eastern Canada). This would, presumably, mean eliminating: Minnesota, Iowa, Missouri, Arkansas, and Louisiana (bordering the Mississippi River on the west) and Mississippi, Alabama, Georgia, South Carolina, and Florida (on the south).

Unfortunately, each of these deleted states, with the exception of Iowa and Missouri, contains significant areas of highly acid rain-sensitive surface waters. And Missouri is one of the top 5 SO_2-emitting states. Consequently, unless one were to assume (which is not the case) that only areas in the extreme northeastern portion of the U.S. are endangered by acid rain, it makes little if any sense to truncate the control region to the south and west.

As far as expanding the control region is concerned to cover all 48 contiguous states, this would in fact encompass several states (notably North and South Dakota, Nebraska, Kansas, New Mexico, Arizona, and Nevada) with few if any acid rain-sensitive areas. Moreover, because western soils tend to be more alkaline than in the east and the rainfalls less acidified, even where low-alkalinity lakes exist in the West, their potential for damage is diminished relative to the East. Finally, acid rain, where it exists in the West, is primarily attributable to nitrogen oxides and automotive emissions, in contrast to the utility-derived sulfur emissions that predominate in the East. Thus, control needs and strategies will be rather different in the two halves of the country.

Beyond a 31-state region, whether one includes additional states becomes more a matter of political tradeoffs than of scientific or technological imperatives.

In short, the approaches of the various Committee bills and that advocated by NWF and the National Clean Air Coalition are well-grounded in science and can be readily justified technically.

It is entirely appropriate, as the Committee bills have done, to emphasize SO_2 emissions as the cornerstone of an acid rain control program, since two-thirds or more of the rainfall acidity in the East is associated with sulfur- (rather than nitrogen-) based pollution. Coal-fired electric generating plants are appropriately emphasized as the predominant sources in the East of sulfur dioxide emissions (accounting for some three-quarters of such emissions).

It is also fair and appropriate, as three of the Committee bills do (all but the Durenberger bill, which delegates allocation decisions to the Administrator), to assess emission reduction burdens on the basis of excess emissions above a specified threshhold (expressed in pounds of SO_2 per million Btus of energy). This approach ensures that sources which in the past have taken steps to reduce their emissions (or which pay a premium for less-polluting fuels) are given credit for any emission reductions they are able to achieve. It also rewards efficient operations.

These bills, in giving individual States the flexibility of allocating required emission reductions among emitting utility and non-utility sources in the most cost-effective combinations, have the great virtue of keeping the costs of control down. And, in permitting and encouraging interstate and intrastate trading of emission reduction credits, they permit utilities to take advantage of economies of scale and of process and other efficiencies that enable certain utilities to reduce emissions more economically than other utilities.

While we support the concept of the lowest cost control program that will achieve the necessary level of SO_2 emission reductions, we are mindful and appreciative of the fact that some departures from least-cost controls may be necessary in some instances to avoid undue burdens on segments of the coal and utility industries. We have avoided taking a hard and fast position on the mechanics of how emission reductions are required to be accomplished (except that we have a strong preference for specifying the general allocation mechanism in the statute rather than leaving it to the vagaries of administrative implementation or to the divergent approaches of 31 or 48 State Public Service Commissions), or how the costs of the control program will be allocated among electric power generators, users, and consumers (and others?).

Again, although we generally favor the principle that the polluter should pay, we have no strong preference for one funding mechanism over another, as long as the requisite level of acid rain reduction is achieved.

It should be no surprise, therefore, that the Administration's posture -- as announced in the State of the Union -- of more research-and-no-meaningful action, despite the wide array of acceptable and responsible approaches for achieving necessary SO_2 emission and acid deposition reductions, is a real disappointment to us. So, I should hasten to add, was the failure of the Democrats to address this issue, in their response to the State of the Union message.

Given the legal and scientific imperatives surrounding the acid rain issue, as I will discuss later in this statement, the failure to address this issue head-on (as the President challenged Ruckelshaus to do when he was sworn in as EPA Administrator -- with all America as witnesses on the evening news) must be regarded as simply avoiding leadership responsibility -- whether the leader is a Republican or Democrat, Conservative or Liberal, President of the United States or Minority Leader of the Senate.

EPA Administrator Ruckelshaus, in his testimony last week, stated the Administration was not prepared to recommend an acid rain control program based upon "the current state of scientific knowledge," which the Administration evidently regards as inadequate. On the other hand, Mr. Ruckelshaus asserted that complete scientific certainty will not be insisted upon by the Administration before it would be willing to support a control program. Implicit in this assertion is the acknowledgement that environmental controls must inevitably be imposed in the absence of total certainty or scientific understanding.

We believe we are joined by both the vast majority of the American public and of the scientific community which has studied the acid rain problem in the conviction that what we already know about the causes, effects, and cures of acid rain amply justifies and requires strong and effective steps to prevent the problem from getting worse and that such action must begin now, not way on down the road.

III. THE SEVERITY AND EXTENT OF THE ACID RAIN PROBLEM

Although the most clearcut evidence of acid rain impacts relates to its effects on high-elevation lakes in areas with soils of limited buffering capacity and only a couple of hundred U.S. lakes can be deemed "dead" at the hands of acid rain, the number of lakes that are "dying," acidified, or vulnerable to acidification is far greater and growing. As the first National Academy of Sciences report noted in 1981, if the emission of acid rain precursors is not reduced, the number of acidified lakes in eastern North America will "more than double" by 1990.

And, although Administrator Ruckelshaus in his testimony last week suggested that there was an "emerging" issue in the scientific community as to whether lake acidification is an immediate or a long-term process, the prevailing view in the scientific community is that poorly buffered lakes become gradually acidified as their alkalinity or buffering capacity is used up. (Obviously, in highly sensitive areas, such as high-altitude lakes in the Northeast, the infusion of highly acidic precipitation, snow melt runoff and dry deposition may produce a rapid acidification response). To the extent this is indeed the case the longer we wait to reduce the emission of acid rain forming pollutants, the more sensitive lakes and streams will exhaust their buffering capacity ("go over the edge," as it were) and become acidified. As Mr. Ruckelshaus himself noted in his testimony, USGS Bench-Mark data indicate that stream sulfate levels (a measure of acidification) have been increasing at a number of sites in the Southeast and West over the past 10 to 15 years, demonstrating both the progressive nature of the acid rain problem and the fact that the problem is no longer confined to the Northeastern United States.

The Congressional Office of Technology Assessment (OTA), in its Interim Report, issued in July 1982, noted that some 9,400 lakes and 60,000 miles of streams in the eastern half of the country are damaged or acidified, as a result of acid deposition, or otherwise vulnerable to acid rain damage.

In addition to vulnerable and acidified waterways in the Northeast, the OTA report identified substantial aquatic resources in many other regions with a significant acid rain damage potential. Specifically, these areas and the aquatic resources at risk include:

Region	Sensitive Area (mi^2)	Total Lakes (#)	No. at Risk	Total Streams (mi.)	Stream Miles at Risk
E. Penna./ S. New Eng.	20,947	1,320	1,056	10,456	4,163
W. New York/ Penna.	25,051	376	301	8,792	5,364
Appalachian Plateau	16,190	13	--	9,649	5,886
Blue Ridge/ Great Smokies	20,964	126	--	14,297	9,150
Coastal Plain	9,264	241	--	2,260	972
Lower Miss.	13,075	170	--	6,629	2,851
Indiana/Ky.	8,603	9	--	3,794	1,631
Wisc./Mich. Minn.	48,659	10,697	4,781	19,657	3,580

As is summarized in Part IV(B)(2) of this statement, the U.S.-Canada MOI Work Group reports have also attempted to tabulate the aquatic and other resources potentially at risk as a result of acid rain. On a state-by-state basis, the MOI reports provide the following geographic distribution of vulnerable aquatic resources (only areas outside of New York and New England are listed here):

State	Surface Water Area at Risk (km^2)
NJ	810
MD	1,040
PA	590
VA	1,670
WV	140
AL	1,290
FL	410
GA	1,910
KY	430
MS	1,120
NC	9,320
SC	640
IN	50
MI	1,690
TN	200
AR	1,480
OK	1,090
TX	10

Other resources are likewise at risk as a result of unabated acid deposition. These include forest resources, certain agricultural crops, construction materials and car and other paint finishes, and human health (as an indirect result of drinking water and fish contamination). Although the precise natue, extent, and monetary value of acid rain impacts associated with these resources cannot currently be quantified (and probably will never be fully quantifiable), it is apparent that the ultimate price tag could easily reach many billions of dollars a year.

Again, the MOI Work Group reports have sought to tabulate the extent of the forest and crop acreages potentially at risk due to acid rain. All told, some 40 million cubic meters of timber growth could be in jeopardy. This represents about 10% of the combined hardwood and softwood growth in the eastern U.S. In addition, two major crops -- tobacco and soybeans -- have approximately 20% of their yield grown under heavy sulfate deposition regimes (i.e., greater than 40 kg/ha.yr.)

The major forest resources at risk are located in Texas (18 million cubic meters), Louisiana (12 million cubic meters), Tennessee (5.1 million cubic meters), Mississippi (2.6 million cubic meters), Missouri (1.1 million cubic meters), Oklahoma (900,000 cubic meters), and Illinois (400,000 cubic meters).

An additional 251.5 million cubic meters of forest growth occur in areas receiving intermediate levels of sulfate deposition (i.e., between 20-40 kg/ha.yr), with the heaviest susceptible growths in Georgia, Alabama, North Carolina, South Carolina, Mississippi, and Virginia.

Of the 16.7 billion kilograms of corn yields and 11.3 billion kilograms of soybean yields in areas receiving more than 40 kg/ha.yr of sulfate deposition, the States whose production of these crops is potentially in greatest jeopardy are, for corn: Ohio (8.6 billion kg), Michigan (2.3 billion kg), Kentucky (2 billion kg), and Indiana (1.1 billion kg). For soybeans, they are: Ohio (3.3 billion kg), Arkansas (2.9 billion kg), and Tennessee (1.1 billion kg).

In 1981, the National Wildlife Federation did an assessment of the overall acid rain vulnerabilities of the 27 States east of the Mississippi River. This assessment was based both on the average rainfall pH experienced in each of these states and on the acid rain sensitivity of the fishery, soil, crop foliage, and masonry resources in these states. Of the 26 states we had enough data to fully evaluate (data was not adequate for Louisiana), fully 15 were classified as extremely vulnerable to acid rain damage overall. Ten of the remaining 11 states were rated as moderately vulnerable to acid rain damage. Only 1 state -- Florida -- was rated as "slightly" vulnerable. But even Florida is known to have some highly acid rain-sensitive lakes in portions of the state.

Finally, the National Wildlife Federation has just completed a State-by-State Compendium of what is known about acid rain and its effects in 21 states -- 19 of them outside of New York and New England.

For three of the states of particular interest to members of this Committee, let me highlight some of our key findings:

Tennessee

--Although sources in Tennessee emitted over a million tons of sulfur dioxide in 1980, computer models indicate that up to 87% of the total sulfur deposited in Tennessee origintes outside of the Tennessee, Kentucky, North Carolina, South Carolina Region. (Office of Technology Assessment, "Regional Implications of Transported Air Pollutants: An Assessment of Acidic Deposition and Ozone," Interim Draft, July 1982; Adapted from Bhumralkar, et al., "Application of a Regional Air Pollution Model (ENA MAP-1) to Study Interstate Sulfur Deposition Over Eastern U.S.A. and Canada," data from J. Shannon, Argonne National Laboratory, ASTRAP model, 1981.)

--The average rainfall pH reported in the state in 1981 was 4.4 -- 16 times as acidic as natural, unpolluted rain. (National Wildlife Federation, "Acid Rain Vulnerability of the 27 States East of the Mississippi River," October 1981.)

--Average precipitation pH in the Great Smoky Mountain National Park has decreased from 5.3 in 1955 to 3.7 in 1980 -- about 80 times as acidic as natural rain. (Boyle, Robert H. and R. Alexander Boyle, "Acid Rain," Schocken Books, Inc., New York, Spring 1983.)

--Of 52 sampling sites located in the Blue Ridge Province, 52% showed pH decreases with time since 1965. Alkalinity (i.e., buffering capacity) has shown a parallel decrease at 67% of the sampled sites. (TVA Division of Water Resources, Office of Natural Resources, Technical Report Series, A Review of Water Quality Data in Acid Sensitive Watersheds Within the Tennessee Vally, March 1982.)

--The pH decreased at 71% of 30 sampling sites in low alkalinity headwater streams in the Blue Ridge Province in the 1970's in comparison with pH data collected prior to 1950. (TVA Division of Water Resources, Office of Natural Resources, Technical Report Series, A Review of Water Quality Data in Acid Sensitive Watersheds Within the Tennessee Vally, March 1982.)

West Virginia

--Although West Virginia sources emitted some 1.1 million tons of SO_2 in 1980, up to 77% of the total sulfur deposted in the State originates outside of the West Virginia, Virginia, Maryland, Delaware, Pennsylvania region (according to computer models). (Adapted from Bhumralkar, et al., "Application of a

Regional Air Pollution Model (ENA MAP-1) to Study Interstate and International Sulfur Deposition Over Eastern U.S.A. and Canada," data from J. Shannon, Argonne National Laboratory, ASTRAP model.)

--The average rainfall pH reported in the state in 1981 was 4.3 -- 20 times as acidic as natural rain. In 1978, Wheeling, West Virginia, received the most acidic rainfall ever recorded -- a pH of 1.5 -- over 10,000 times as acidic as natural rain. (National Wildlife Federation, "Acid Rain Vulnerability of the 27 States East of the Mississippi River," October 1981; National Wildlife Federation, "Acid Rain, What It Is-How You Can Help," 1982.)

--West Virginia received an average of 30-45 kg/ha.yr. of sulfate from precipitation in 1980 -- about double the target loading recommended for the protection of even moderately sensitive surface waters. (Impact Assessment Work Group I, U.S.-Canada Memorandum of Intent on Transboundary Air Pollution, Final Report, Jan. 1983.)

--Over half of West Virginia's native brook trout streams lie in hard sandstone watersheds, with little acid neutralizing capacity. Some 150 miles of native brook trout streams are threatened, with springtime pH dips to 4.8 (stocked trout mortality often begins when pH declines below 6.0). Both Shavers Fork and the Cranberry River have experienced significant pH depressions. (Gasper, Donald C., "Acid Rain, Snow and Trout in West Virginia," West Virginia Department of Natural Resources, 1980.)

--Soil chemistry indicates that acid rain is dissolving out soil nutrients, resulting in soil impoverishment in Parsons, West Virginia. (Gasper, Donald C., "The West Virginia Acid Rain Fishery Problem," West Virginia Department of Natural Resources.)

Texas

--According to computer models, up to 85% of the total sulfur deposited in Texas may come from outside the Texas, Oklahoma, Arkansas, and Louisiana region. (Adapted from Bhumralkar, et al., "Application of a Regional Air Pollution Model (ENA MAP-1) to Study Interstate and International Sulfur Deposition Over Eastern U.S.A. and Canada," data from J. Shannon, Argonne National Laboratory, ASTRAP model.)

--The Houston-Galveston area had precipitation with a pH value as low as 3.0 in 1981 -- almost 400 times as acidic as natural rain. Monitoring data indicate that the sensitive northeast area of Texas is receiving rain with the highest acidity. For example, the average pH of rain at Tyler, Texas decreased (i.e., acidity increased) from 4.8 in 1979 to 4.3 in

1980 (20 times the acidity of natural rain). (Texas Energy and Natural Resources Advisory Council, "Plan to Evaluate Acid Deposition Issues in the State of Texas," Final Report, Energy Development Act Project No. 80-L-11-6, January 1982.)

--The formation of acidic substances from precursor pollutants probably occurs more rapidly in Texas because of the greater abundance of sunshine and higher mean temperature than in more northern latitudes. Vegetative damage may also be exacerbated because of higher evaporation rates. Some native vegetation in certain locales in western Texas may be adapted to higher alkalinity and may be especially vulnerable to acidity increases. Long term agricultural damage is possible in northeast Texas due to soil degradation, decreased nutrient recycling, and increased susceptibility to other stresses. (Texas Energy and Natural Resources Advisory Council, "Plan to Evaluate Acid Deposition Issues in the State of Texas," Final Report, Energy Development Act Project No. 80-L-11-6, January 1982.)

--Oak-pine forests are the dominant native vegetation in Texas and are especially vulnerable to adverse effects of acid deposition. Other especially sensitive Texas tree species, which grow on poorly buffered soils are black willow, alder, apple, birch, American elm, pear, and catalpa. The timberlands of northeast Texas are generally most sensitive to acid rain due to the combination of comparatively high rainfall acidities, low soil buffering capacities, and the vulnerability of its dominant vegetative species. (Texas Energy and Natural Resources Advisory Council, "Plan to Evaluate Acid Deposition Issues in the State of Texas," Final Report, Energy Development Act Project No. 80-L-11-6, January 1982; Texas Energy Development Fund, "Acid Deposition in Texas: Technical Summary and Perspective" Volume II, Texas Energy and Natural Resources Advisory Council, Report No. EDF-057, Jan. 1982.)

In short, acid rain is a signifiant and growing problem, the impacts of which are by no means confined to the northeast.

Furthermore, any assessment of the benefits of an acid rain control program geared to the reduction of SO_2 emissions must also consider the non-acid rain-related benefits that will result directly from reducing SO_2 (and SO_2-derived sulfate) pollution. These benefits include: reduced visibility impairment, reduced materials damage, and reduced death and serious illness on the part of those afflicted with heart and lung impairments (especially the young and the elderly).

IV. THE SUPPORT FOR ACID RAIN CONTROLS IS WIDESPREAD AND GROWING

A. Legal Imperatives

1. U.S.-Canada Memorandum of Intent on Transboundary Air Pollution (MOI)

In August, 1980, the United States and Canada signed a Memorandum of Intent (MOI), which stated the intent of both nations to develop and conclude as soon as possible a cooperative bilateral agreement to deal with acid rain. The MOI also committed both countries to take interim action under existing law to combat acid rain, and to vigorously enforce existing law, and specifically to:

- -- "combat transboundary air pollution in keeping with...existing international rights, obligations, commitments and cooperative practices...."
- -- "as a matter of priority both...improve scientific understanding of the long range transport of air pollutants and its effects and...develop and implement policies, practices and technologies to combat its impact..."
- -- "[pending conclusion of a bilateral agreement,] take interim actions available under current authority to combat transboundary air pollution."
- -- "develop domestic air pollution control policies and strategies, and as necessary and appropriate, seek legislative or other support to give effect to them."

A report by the Subcommittee on Acid Rain of the Canadian House of Commons pointed out that:

> "The United States should be reminded periodically that we in Canada feel bound by this Memorandum and we expect a reciprocal commitment from the United States, notwithstanding a change of Administration. To put any other interpretation on this document would jeopardize future negotiations between our two countries. We have treated our obligations seriously under this document.... To date it appears that the

> United States is not approaching the problem in the same spirit." Still Waters, 1981, p. 92.

A 1981 report by the U.S. Department of State and the Council on Environmental Quality likewise concluded that, "To reduce the threat caused by acid precipitation, the United States should [*inter alia*]... [g]o forward on work between the United States and Canada under the Memorandum of Intent to control transboundary air pollution. *This work includes negotiation of a bilateral agreement as soon as possible."* *Global Future: Time to Act*, Jan. 1981, p.141.

2. Trail Smelter Arbitral Tribunal

Well before the advent of the MOI, the Trail Smelter Arbitral Tribunal stated the applicable principle of international law in its 1941 final decision:

> No state has a right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the persons or property therein, when the case is of serious consequences and the injury is established by clear and convincing evidence.

3. 1972 Stockholm Declaration, Principle 21

Principle 21 of the 1972 Stockholm Declaration of the United Nations Conference on the Human Environment affirmed that:

> States have, in accordance with the Charter of the United Nations and the principles of international law..., the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

4. U.S.-Canada Great Lakes Water Quality Agreement

The Seventh Annual Report of the U.S. Canada International Joint Commission (IJC) on Great Lakes Water Quality concluded that:

> ... [T]he significance of atmospheric pollution to Great Lakes water quality as reported by the Great Lakes Water Quality and Science Advisory Boards, compel the Commission to advise the Governments of the extent and possible consequences of the acid rain problem in the Great Lakes Basin ecosystem. In this regard, the Commission believes that the potential for impacts on the Great Lakes is sufficient to require consideration of this problem under the provisions of Article VI(1)(e) of the 1978 Great Lakes Water Quality Agreement.... The Commission recommends that the Governments of the United States and Canada consult in a timely manner on appropriate actions to substantially reduce atmospheric emissions of sulphur and nitrogen oxides from existing as well as new sources, and that the Governments ensure ... measures for the control of the long-range transport of airborne pollutants, with special attention in the near future to acid rain.

(Report, Oct. 1980, p. 55.)

The Great Lakes Water Quality Agreement commits the parties to developing and implementing as soon as practicable programs and other measures directed toward the achievement of the Agreement's water quality objectives. It also mandates the enactment of any additional legislation that may be necessary in order to implement such programs and measures.

5. Clean Air Act, Section 115

Finally, under Section 115 of the Clean Air Act, the EPA Administrator is required to notify responsible states that revisions are required to their State Implementation Plans, upon receipt of reports, surveys, or studies from a duly constituted international agency indicating that U.S. emissions are causing or contributing to endangerment in a foreign country. In response to a December 23, 1980, request from Senator Mitchell, former EPA Administrator Costle on January 13, 1981, formally determined that the IJC's Seventh Annual Report on Great Lakes Water Quality, and its conclusions and recommendations regarding transboundary air pollution, served to fully meet the prerequisites of Section 115:

> The International Joint Commission which is a duly constituted international agency under Section 115, has recently transmitted a report which addresses the issue of acid deposition. My review of the October 1980 Seventh Annual Report on Great Lakes Water Quality of the International Joint Commission (IJC) leads me to conclude that the IJC has found acid deposition results in significant harm in both the U.S. and Canada and that emission sources in both the U.S. and Canada contribute to the problem through the long-range transport of air pollution....
>
> Finally, the IJC recommends in the Report that the Governments of the United States and Canada, "undertake further actions to reduce atmospheric emissions of the oxides of sulfur and nitrogen from existing as well as new sources." (Report at 5.)

The Administrator also concluded that another prerequisite of Section 115 action -- that Canada "has given the United States essentially the same rights" with respect to emission sources in Canada as is provided by Section 115 -- had likewise been met (by Section 21.1(1) of legislation approved by the Canadian Parliament on December 17, 1980).

Unfortunately, the current EPA has done nothing to implement the mandatory directives of Section 115, despite the triggering determination of more than a year ago.

On January 12th of this year, the National Wildlife Federation joined the States of New York, Maine, Minnesota, Vermont, and Rhode Island, and Minnesota and the Natural Resources Defense Council and the Sierra Club in notifying EPA Administrator Ruckelshaus of our intent to sue him, in part based on the Agency's failure to discharge its obligations under Section 115.

B. Authoritive Calls for Action

Although EPA Administrator Ruckelshaus and others have sought to characterize the acid rain issue as largely a matter of political geography ("tell me the person's position on acid rain and I'll tell you what part of the country he's from"), in fact there is broad and growing support for acid rain controls throughout the United States and through many sectors of society.

1. The National Commission on Air Quality

The bipartisan National Commission on Air Quality, established by Congress under the 1977 Clean Air Act Amendments, concluded that: "Congress should require a significant reduction by 1990 in the current level of sulfur dioxide emissions in the eastern United States" and "should consider whether to adopt a phased program requiring interim reductions by 1985." (NCAQ Report, 1981, Recommendation #97, pp. 64-65). The Commission also recommended strengthening of the interstate pollution abatement provisions of Section 110(a)(2)(E) and 126 of the Clean Air Act (Recommendation #92,

p. 64); consideration of whether to enact a moratorium on relaxing existing sulfur dioxide emission limits in state implementation plans, unless it can be shown that undue economic or other hardship would result from retaining current limits; and consideration of whether conversion of utilities to coal should be accompanied by measures to prevent a net increase in SO_2 emissions (Recommendations #96, p. 64).

2. U.S. Canada MOI Work Group Reports

The initial reports emanating from the MOI Work Groups were quite strong:

The U.S.-Canada Work Group on Transboundary Air Pollution, established under the MOI, and consisting of the most knowledgeable acid rain experts in the two governments, concluded that "what is known about acid deposition indicates that the problem is genuine and serious," that, if allowed to go unchecked, it "could result in substantial economic and social costs, and that, "[a]s a practical matter, the best way to reduce acid deposit effects is to reduce emission of pollutants that cause the problem." Work Group 3A, Phase I Report, February, 1981, p. 9. The Report also stated that, "[a]s a practical matter, the best way to reduce acid deposition effects is to reduce emissions of pollutants that cause the problem" (id.); that, to this end, "solutions should be sought in the near term" (Jan. 15, 1981, transmittal letter); and that "new legislation will likely be required to fully and expeditiously address this problem" (Phase I Report,

p. 9). The Phase II Report of the Work Group on Impact Assessment concluded that protection of moderately sensitive lakes from acid rain impacts "may require a reduction in sulphate deposition of more than half." Work Group 1, Phase II Report, October, 1981, p. 1-3.

The U.S. Canada Research Consultation Group concluded in its first report, in 1979, that: "In view of mounting evidence of serious and continuing environmental degradation in eastern North America as a result of acidification, it should be recognized that delays in undertaking action to address the presently deteriorating situation will result in greater damage and possible economic costs in the future." RCG, 1st Report, 1979, p. 25.

The final MOI Work Group reports reached similar conclusions:

- "[W]e conclude that acidic deposition has caused long- and short-term acidification of some low alkalinity surface waters in Canada and the U.S." MOI Work Group I, Final Report, p. 1-12 (Jan. 1983).
- "[T]he Work Group concludes that reductions from present levels of total sulphur deposition would reduce further chemical and biological alterations to low alkalinity surface waters currently experiencing effects and would lead to eventual recovery of those waters that have been altered by deposition." Id.
- The Canadian members of the Work Group concluded that "present deposition of sulphate in precipitation [must] be reduced to less than 20 kg/ha.yr. [20 kilograms per hectare per year; about 18 pounds per acre] in order to protect all but the most sensitive aquatic ecosystems in Canada." Id., p. 1-7. The U.S. Work Group members, while not willing to accept a specific target loading, did agree that chemical and

biological effects have not been reported in North America for regions currently receiving sulphate loadings in precipitation at rates of less than about 20kg/ha.yr.; that long-term chemical and/or biological effects and short-term chemical effects have been observed in some low alkalinity surface waters experiencing loadings greater than about 30 kg/ha. yr.; and that evidence of chemical changes exists for some waters in regions currently receiving between about 20-30 kg/ha.yr sulphate in precipitation. Id., p. 1-11.

"It is generally accepted that SO_2 is the primary species causing damage to materials." Id., p. 1-19. "It is reasonable to assume that acidic deposition due to long-range transport and transformation of air pollutants contributes somewhat to material effects." Id., p. 1-18. Common construction materials at risk include limestone, carbon steel and galvanized steel sheet. Id., p. 1-19.

The resources potentially at risk in the eastern U.S. include:

-- Approximately 36,000 km^2 of eastern U.S. surface water area (25% of the total), which is located in areas of low and moderate buffering capacity and of deposition greater than 20 kg/ha.yr in precipitation. Only 24% of the total surface water area can be regarded as low-risk due to low sensitivity and less than 20 kg/ha.yr sulphate deposition. Id., p. 1-21.

-- Approximately 20% of the total yield of soybeans and tobacco in the eastern U.S. is grown in areas where sulphate deposition regularly exceeds 40 kg/ha.yr. Id., p. 1-22.

-- Approximately 10% of the combined annual hardwood and softwood forest growth in states east of the 100° meridian (476 million m^3 in total in 1977) occurs under sulphate deposition regimes greater than 40 kg/ha.yr. More than 75% of the additional forest growth occurs under sulphate deposition regimes between 20-40kg/ha.yr. Id., p. 1-22.

3. Global Future Report by CEQ and Dept. of State

A 1981 Report to the President by the Council on Environmental Quality and the Department of State on global resources, environment and population, recommended that the United States should: "[i]ntensify efforts under the Clean Air Act or other legal authority to control acid deposition...," with "amendments to the Clean Air Act" possibly "required to increase EPA's ability to address acid deposition and the regional air quality degradation caused by long-range transport in an efficient and equitable manner." Global Future: Time to Act, January 1981, pp. 141-42.

4. National Academy of Sciences

The prestigious National Academy of Sciences concluded in its 1981 Report on the ecological consequences of fossil fuel combustion that the acid rain "picture is disturbing enough to merit prompt tightening of restrictions on atmospheric emissions from fossil fuels and other large sources" (p. 7); that only the control of SO_2 and NO_x emissions can significantly reduce the rate of deterioration of sensitive freshwater ecosystems (p. 181); that control of SO_2 from new power plant alone would be insufficient to significantly reduce these acid rain impacts, so restricctions on older plants must be considered (p. 181); and that significant reduction in the rate of deterioration of sensitive freshwater ecosystems would require "a reduction of 50 percent in deposited hydrogen ions" in the most seriously affected areas (p. 181). The Report also concluded that continued emissions of sulfur and nitrogen oxides at present rates, "in the face of clear evidence of serious hazard to human health and to the biosphere," will be "extremely risky" from the standpoint of long-term economic considerations as well as biosphere protection (p. 3). NAS, Atmosphere-Biosphere Interactions: Toward a Better Understanding of the Ecological Consequences of Fossil Fuel Combustion, Sept. 1981.

5. U.S.-Canada International Joint Commission

The U.S.-Canada International Joint Commission established by the two governments to safeguard the quality of U.S.-Canada boundary waters) has urged "appropriate actions to substantially reduce atmospheric emissions of sulphur and nitrogen oxides from existing as well as new sources..." IJC, Seventh Annual Report on Great Lakes Water Quality, October 1980, p. 55.

6. 104 Acid Rain Scientists (1982)

One-Hundred-and-four acid precipitation scientists throughout the United States (representing nearly 9 out of 10 of those responding) have endorsed an NWF position statement which concludes that "what is already known about acid deposition justifies and requires immediate legislative steps to begin abating sulfur and nitrogen oxide emissions, particularly in the eastern half of the United States."

7. Stockholm Conference on Acid Rain

The June 1982 Stockholm Conference on acid rain, attended by 28 countries and international organizations (including the U.S.), concluded (among other things) that: "in recent decades acid deposition has increased significantly, due primarily to increases in emissions of SO_x and NO_x through the combustion of fossil fuels"; "the acidification problem is serious and even if deposition remains stable, deterioration of soil and water will continue and may increase unless additional control measures are implemented and existing control policies are strengthened"; and "further concrete action is urgently needed...to reduce air pollution, including long-range transboundary air pollution" (with programs to reduce sulfur emissions deemed to be "a matter of urgency").

8. Letter from 15 Western Senators

The latest additions to the ranks of Senators supporting acid rain controls are 15 Western Senators, including several staunch conservatives, among them members of this Committee. These Senators, along with 9 Western members of the House, have urged President Reagan to "not delay in leading the country to an equitable and cost-effective solution to the [acid rain] problem." They also said they intend to work with others to develop such a plan, stating that they "do not agree that [environmental damage being caused by acid precipitation] is acceptable..." (The Senators signing the letter were: Sens.

Wallop, Baucus, McClure, Domenici, Melcher, Simpson, Abdnor, Armstrong, Zorinsky, Hatch, Hecht, Pressler, Symms, Garn, and Hatfield.)

Unfortunately, as evidenced by the President's recent State of the Union message, the President has chosen not to take a leadership role on this issue.

9. Positions of Senators Glenn and Lugar

Even in the Midwest, there are signs of support for acid rain controls. Senator Glenn of Ohio, as long ago as last April 14th, noted that "it is time that all of us realize that there will be legislation" to control acid rain, and that "all the evidence suggests that the arguments for control will continue and become stronger." Senator Glenn indicated his intention to develop a legislative proposal based on a 12-year, 10-million-ton reduction in sulfur dioxide emissions.

Senator Lugar of Indiana has similarly acknowledged that "acid rain is clearly a pressing environmental problem" that needs to be addressed legislatively, preferably in a way "that is reasonable in its costs, fair to all regions and beneficial to the environment."

10. State Department Reauthorization Legislation

Congress recently enacted legislation (P.L. 164), the State Department reauthorization Act, which states the sense of the Congress that the President should "proceed to negotiate as expeditiously as possible a bilateral agreement with Canada providing for significant reductions in transboundary air pollution" while minimizing economic dislocations in both countries. (Section 1008(b)).

11. Cleveland Plain Dealer Editorial

The Cleveland Plain Dealer, in an October 9th editorial summed things up well in castigating anti-acid rain control politicians and Ohio utility and coal industries as being "wrong-headed" and guilty of "unrealistic, specious politicking" in dismissing acid rain control legislation out of hand. As the editorial aptly concluded:

> ...[T]here is no way around [acid rain regulation]. Ohio's powers, both in industry and government, could do a great deal to lessen the blow by working to frame the legislation rather than running from it and thereby relinquishing control over the unavoidable. Acid rain legislation is an inescapable part of environmental progress -- legislation that is worthwhile and, although costly, not nearly so horrific as state politicians and industrialists would have us believe.

12. State and Territorial Air Pollution Program Administrators

The State and Territorial Air Pollution Program Administrators (STAPPA), late last June endorsed a two-phased 8- to 10-million-ton SO_2 reduction program encompassing a 31-state region and incorporating a funding mechanism which covers all or part of the capital costs of control.

13. Midwestern Governors

The Midwestern Governors, in mid-October approved an acid rain position calling for a "significant phased-in sulfur dioxide emissions reduction" in the form of "strong federal legislation to mitigate the acid deposition problem." The states represented included Missouri, Indiana, Illinois, Kansas, South Dakota, Iowa, and Nebraska.

14. Tennessee Valley Authority

In testimony before two House subcommittees, the Nation's largest producer of electricity, the Tennessee Valley Authority, has come out in support of "further reductions in SO_2 and NO_x emissions" to control acid rain, noting that, "if permitted to use the most cost-effective emission reduction techniques," TVA could "meet its fair share of a 12-million-ton national reduction goal with an increase in electric rates of only 4 to 6 percent."

TVA Commissioner Dave Freeman has been even more emphatic:

> TVA over a year ago reached the conclusion that the acid rain problem is real, that it is related to the combustion of fossil fuels and that it is correctable at a reasonable price. Through the course of the national dialogue, we have consistently maintained that a preventive sulfur dioxide control strategy can be achieved at a reasonable cost, and that these investments are worth making to preserve a livable environment. And we have the numbers and the experience to back up our conclusions.

For the skeptics who continue to question the reality of the problem and our ability to control it, he had these comments:

> It is true that there is no "smoking gun," no proof positive of cause and effect and no precise estimate of the damage. There was no such proof when Congress passed the ... Clean Air Act in 1970. There never is such proof with a problem as complex as air pollution. The only proof positive would be to wait and see whether the lakes keep dying and whether the forests become blighted. But our own common sense should tell us that the conclusions of all these scientific studies is correct. What goes up does come down and if you clean up what goes up it will clean up what comes down.

15. American Public Power Association

The American Public Power Association, representing 1,750 municipally owned utilities throughout the U.S., announced its support for acid rain controls late last summer.

16. Private Utilities

Even among private utilities, there are some who have read the handwriting on the wall and want to play a role in designing acid rain control legislation. These include, Northern States Power Company in Minneapolis and the Pennsylvania-based Duquesne Light.

17. General Motors Corporation

Others in private industry have also urged their colleagues in the utility and coal industries to bite the bullet and support responsible acid rain control legislation.

One of the earliest was General Motors Corporation. In a mid-January speech to utility executives in New York, General Motors Vice President for Environmental Activities, Dr. Betsy Ancker-Johnson, stated her view that "industry must take on the task of reducing sulfur dioxide emissions from boilers, and utility boilers are obviously major sources." She noted that, "while we don't have all the science in hand [about acid rain], we do know a lot -- enough, I think, to start moving." While noting the difficulties faced by the utility industry in agreeing on a sulfur dioxide control strategy, given the uncertainties about causal relationships, Dr. Ancker-Johnson noted that "others inn the regulatory equation are not constrained by such difficulties and will be happy to define your control requirements." She encouraged the utility industry not "to relearn all of the regulatory lessons" the auto industry has experienced: "Science and logic are just not enough, and I am hopeful that you can be more politically astute than my industry sometimes was. I think you will find your ultimate burden easier if you begin to take some of the first steps now -- before it appears that you must be forced every inch of the way."

She concluded her discussion of acid rain with the following observation:

> Make no mistake, the available scientific evidence points to the need to reduce sulfur dioxide emissions. I believe, one way or another, some reductions will come, and an initiative on your part may allow you to influence the dosage of this medicine we all must take.

Dr. Ancker-Johnson also made the important point that, "even if the 'acid rain' problem disappeared tomorrow, we could still face pressure for sulfur dioxide control" because of its role in visibility reduction. She cited visibility studies done by GM's Research Laboratories in the eastern U.S. which concluded that "the large population and industrial centers in the midwestern U.S. play a significant role in the ozone, acid deposition, and haze problems over much of the eastern half of the country."

18. Atlantic Richfield Corp.

In mid-August, the Atlantic Richfield Corporation, which has large low-sulfur coal holdings, announced its support for a phased-in, flexible sulfur reduction approach that encourages fuel switching over technology controls. ARCO felt that "recently compiled scientific data justify congressional action to impose appropriate additional controls on sulfur dioxide emissions," and that it need to take a public stance to this effect in order to become "a constructive participant in the congressional debate over acid deposition."

ARCO has joined forces with 10 other Eastern and Western low sulfur coal producers in an Alliance for Clean Energy, which is supporting limited SO_2 reductions to be phased in over time.

19. Lou Harris Public Opinion Polling

Lou Harris, the national pollster, told the Coalition of Northeastern Governors on December 4th what his polls had found to be the attitude of the people of this country on acid rain.

-- By a 90-7% margin -- nearly 13 to 1 -- Americans regard acid rain as a "serious problem" in this country today.

-- Public familiarity with the acid rain problem has more than doubled since 1980 (only 30% then, 63% now).

-- By an 88-9% margin the public correctly regards "emissions from plants and factories that burn coal" as an "important source of acid rain, and 50% consider this a "very important" source.

-- People all over the country -- in the East, the West, the Midwest and the South -- believe the costs for cleaning up acid rain should be born both by the consuming public nationwide and by the corporations who are involved in creating the problem.

-- Congress itself, by a 68-18% majority (nearly 4 to 1), wants to pass a law requiring existing plants to meet stricter sulfur dioxide emission standards, and by a slightly bigger 63-14% majority wants to require scrubbers for existing plants.

-- Finally, at a time when very few citizens relish the thought of paying higher taxes, a big 70-26% majority now say they are willing to pay up to $100 extra taxes a year, along with higher utility rates, in order to clean up both water pollution and acid rain.

V. RECENT INDICATIONS OF BROAD SCIENTIFIC SUPPORT FOR ACID RAIN CONTROLS

In order to test the sentiment of the U.S. acid rain research community, we prepared a detailed questionnaire on key issues underlying the scientific and policy debate on acid rain controls. We sent this questionnaire in two installments to a total of 1,027 acid deposition researchers. The first installment was mailed in mid-September 1983 to all 461 U.S. acid precipitation researchers listed in the International Directory of Acid Precipitation Researchers, Interim Edition (October, 1980). A total of 99 responses were received to this mailing (2 of them in November -- too late to include in the tabulation of the results of the first survey). Another 566 questionnaires were mailed on January 20, 1984, to acid rain researchers listed in the International Directory of Acid Deposition Researchers, North American and European Edition (July, 1983), which did not become available to the public until mid-November. (For purposes of this mailing, we sent a questionnaire to all U.S. scientists listed in the 1983 directory who had not been listed in the 1980 edition). In short, we mailed questionnaires to all known acid deposition researchers in the United States.

As of February 7, 1984, 101 responses had been received to the second mailing -- for a total (in both mailings of 200 responses).

The detailed results of the overall survey to date can be tabulated as follows:

1. Principal focus and objective of a national acidic deposition control program:

a.	Reduce precipitation acidity below recommended target levels throughout the sensitive areas of the eastern U.S.	111 (56%)
b.	Controls only on emission sources directly affecting heavily impacted areas of the northeast.	23 (12%)
c.	No further controls pending the results of more research and/or monitoring.	28 (13%)
d.	Controls geared to the northeast only, but expanded monitoring throughout the eastern U.S.	25 (13%)
e.	None of the above.	13 (7%)

2. Most Supportable SO_2 emission control program:

a.	A 10-12 million ton reduction throughout the 31 eastern states plus eastern Canada.	99 (50%)
b.	A 6-8 million ton reduction in 21 states only plus eastern Canada.	16 (8%)
c.	A 3-4 million ton reduction only in a few source states closest to the Northeast.	24 (12%)

d.	A less than 10 million ton reduction, but throughout the 31 eastern states.	16 (8%)
e.	A less than 3 million ton targetted reduction.	10 (5%)
f.	None of the above.	34 (17%)

3. Need to offset new SO_2 emission sources by corresponding further reductions in existing emissions:

a.	Yes	124 (64%)
b.	No	34 (17%)
c.	Other	37 (19%)

4. Risk of irreversible natural resource damage and need to take immediate and decisive steps to stem acid-forming emissions:

a.	Yes	113 (58%)
b.	No	32 (16%)
c.	Other	50 (26%)

5. Need to consider full range of benefits associated with reducing sulfur dioxide emissions:

a.	All benefits should be considered.	150 (82%)
b.	Only acid deposition reduction benefits should be considered.	21 (11%)
c.	Only some SO_2 reduction benefits should be considered in addition to acid deposition reduction benefits.	13 (7%)

6. Appropriateness of emphasizing controls in SO_2 with NO_x sources deferred for later consideration:

a.	Yes, we need to begin expeditiously where we know controls will do them most good.	132 (67%)
b.	No, we need to deal with all major sources of acidification simultaneously.	41 (21%)
c.	Other	23 (12%)

The surveys principal findings can be best summarized as follows:

1. Scientists, by a more than 6-to-1 margin, favored some form of acid precipitation control program over putting off further controls pending the results of more research or monitoring (Question 1).

2. More than two-thirds of all scientists responding favored a control program aimed at protecting all sensitive areas of the eastern half of the country. They favored

this approach over controls geared only toward heavily impacted areas of the northeast by a margin of nearly 3-to-1. (Question 1).

3. Scientists were significantly more supportive of sulfur dioxide controls in the range of 5 to 12 million tons a year than of lesser controls and of broad reductions throughout all or most of the eastern 31 states than they were of targetted reductions in only a few source states (by a nearly 4-to-1 margin). The specific control option receiving maximum support (60%) was a 10-12 million ton reduction in sulfur dioxide emissions throughout the 31 eastern states, plus reductions in eastern Canada. (Question 2).

4. By a nearly 4-to-1 margin, scientists supported the need to offset new sulfur dioxide emission sources by corresponding further reductions in existing emissions -- so that emissions growth does not diminish gains achieved by placing controls on existing sources. (Question 3).

5. Four out of five scientists considered the risk of irreversible natural resource damage due to acid precipitation to be sufficiently great as to necessitate immediate and decisive steps to curtail the emissions that cause acid rain. (Question 4).

6. By nearly 8-to-1, scientists rejected the logic of evaluating a sulfur dioxide-based acid rain control program on the basis of all emission reduction costs, while considering only those SO_2 reduction benefits associated with acid rain. (Question 5).

7. Scientists agreed by more than 3-to-1 that it is appropriate to emphasize controls on SO_2 emissions, where we know they will do the most good, with significant new controls on nitrogen oxide emission sources being deferred for later consideration. (Question 6).

In short, acid rain scientists from every region of the country, in responding to our questionnaire, have overwhelmingly rejected the premise of the Reagan Administration (and of the Byrd bill) that scientific support is lacking for a strong acid rain control program. The same scientists indicated their substantial agreement with the basic approach taken by the various control bills generated in this Committee.

VI. CONCLUSIONS

I'd like to conclude by referencing a review of acid rain issues done by the Hudson Institute for an Indiana group, released in late October. The Hudson Institute report cautions that sportsmen and other "outdoors people," if aroused and activated on the acid rain issue, could well determine the outcome of the acid rain debate. Let me quote a few sentences from the report summary:

> Specifically pertinent to the question of acid deposition, an estimated 45 million fresh water fishermen, and 12 million hunters, among others, would be disturbed if they believe that it would cause serious damage to the woods, streams or lakes -- or even to the aquatic flies on which the fish feed...Although basically low-profile people, they can become very active if they believe their favorite recreation is threatened...
>
> ...Potentially, a great concentration of public opinion on legislation dealing with acid rain might stem from a coalition of some otherwise unlikely partners. That could occur if the National Clean Air Coalition joined with some fishermen's groups and generated enough publicity to get other outdoors recreational groups involved.
>
> This analysis does not imply that the larger coalition or a political groundswell is imminent. As fishermen and hunters now have higher-priority concerns, their votes are driven largely by critical economic issues. On the other hand, in tight political races their views on the acid rain issue could determine the outcome, if they become convinced of the need for action.

I'm here to tell you that this "larger coalition" exists, that the "political groundswell" is here, and that the sleeping giant is awake and wasn't really ever asleep. Furthermore, I can tell you that the National Wildlife Federation, with its more than 4 million members and supporters -- a good many of them sportsmen and other "outdoors people" -- has no higher priority concern than bringing acid rain and its devastating present and potential impacts on our natural resources under swift and effective control.

The train is about to leave the station. Those who want to ensure that acid rain control legislation takes a responsible path should help lay the tracks and get on board. It's time to stop laying in front of the oncoming train.

ACID RAIN, 1984

FRIDAY, FEBRUARY 10, 1984

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, D.C.

The committee met at 9:38 a.m., in room SD-406, Dirksen Senate Office Building, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senators Stafford, Randolph, and Moynihan.

Senator Randolph [presiding]. In a few minutes the able chairman of the committee, Senator Stafford, will be presiding. He has been very cooperative with me because of my travel schedule. I must leave in about 5 or 6 minutes for the airport to fly to Charleston, W. Va., where I have a responsibility of speaking to several hundred employees of the FMC Corp.

We have as our first witness this morning the president of the Kaiser Aluminum Corp. centered in Oakland, Calif., but with plants throughout the country. Mr. Hutchcraft is here.

Are you ready to testify?

Mr. HUTCHCRAFT. Yes, I am, Senator.

STATEMENT OF A. STEPHEN HUTCHCRAFT, PRESIDENT, KAISER ALUMINUM & CHEMICAL CORP., ON BEHALF OF THE ALUMINUM ASSOCIATION, INC.

Senator RANDOLPH. Mr. Hutchcraft, before you begin, would you tell us how many employees are there at the present time at Kaiser Aluminum Corp.?

Mr. HUTCHCRAFT. We have approximately 19,000 employees, Senator.

Senator RANDOLPH. 19,000 employees. The matter of costs, of course, is very important to you.

Mr. HUTCHCRAFT. Yes, they are, sir.

Senator RANDOLPH. Yes. In West Virginia you have a plant at Ravenswood; is that correct?

Mr. HUTCHCRAFT. That is correct, sir.

Senator RANDOLPH. What is the employment at Ravenswood at the plant at the present time?

Mr. HUTCHCRAFT. We have approximately 2,300 employees at our Ravenswood facility, Senator.

Senator RANDOLPH. What was the employment there many years ago when the plant was open?

Mr. HUTCHCRAFT. At peak capacity we had as many as 4,200 employees.

Senator **Randolph**. Yes; I remember that Henry J. Kaiser came there at the time of the announcement of the plant.

Mr. **Hutchcraft**. Yes, he did.

Senator **Randolph**. And he said, we did not come here because of your rivers, there are rivers just as deep or deeper. This is the Ohio River he is speaking of. We did not come here because of your valleys because there are valleys just as wide or wider, but we came here because we thought it was a good climate for employment productivity.

Has that proved to be generally true?

Mr. **Hutchcraft**. Yes, it has, Senator. We have had a long and very pleasant relationship with both the State and with the location and we find that they are a fine group of people to work with.

Senator **Randolph**. Yes; now the matters that you will discuss today are in reference to pending legislation which deals with an important and crucial problem, acid rain, is that correct?

Mr. **Hutchcraft**. That is correct, Senator.

Senator **Randolph**. I do want to say that in talking with you and others, and I have expressed this at the hearing table, we have indicated that the matter of jobs is an important factor in the determination of the way we proceed in reference to coping with acid rain which we realize is a problem. I have a bill pending before this committee in reference to that matter. Are you familiar with that legislation?

Mr. **Hutchcraft**. Yes, I am, Senator. I am familiar with that legislation.

Senator **Randolph**. Would you be in a position to discuss it today?

Mr. **Hutchcraft**. Senator, both the company and the Aluminum Association that I also represent here today support the direction of the legislation that you have proposed on the acid rain issue.

Senator **Randolph**. Yes; I realize that I have been rather provincial in talking with you at the beginning because you do represent the association and the companies in this industry but it is not wrong for me as a Senator and one of the Senators from West Virginia to bring to the attention of the committee in the hearing process that in West Virginia we are identified, and to a considerable degree, with the employment of people and the productivity of aluminum from that location, is that correct?

Mr. **Hutchcraft**. That is absolutely correct, Senator.

Senator **Randolph**. Senator Stafford is now coming in.

Mr. Chairman, I have a plane that I must catch; it is not a chartered plane, I don't have that privilege. I am riding coach. I am going to Charleston to address the employees of the FMC Corp. and you have been very kind to allow me to open the hearing. Mr. Hutchcraft for the Aluminum Association is at the stand.

Thank you very much.

Senator **Stafford**. Welcome to you all this morning in this sequence of hearings with respect to the deadly phenomenon we call acid rain.

Mr. Hutchcraft, unless Senator Moynihan has an opening statement, you may proceed.

Senator **Moynihan**. No, Mr. Chairman. Go right ahead.

Senator **Stafford**. Mr. Hutchcraft.

Mr. HUTCHCRAFT. Thank you, Mr. Chairman.

My name is Steve Hutchcraft. I am president of Kaiser Aluminum & Chemical Corp. and I am also pleased to represent the Aluminum Association, Inc., at these important hearings today.

My remarks will focus on the very damaging impact that various pending acid deposition proposals would have on the industry and the company that I represent. Briefly stated, the proposals pending before this committee would significantly increase electricity costs and drastically affect the international competitiveness and future development of the U.S. aluminum industry. This regrettable consequence would translate into reduced economic growth, lost jobs, lost tax revenues, trade imbalances and a weakening of our country's industrial base.

As a major industrial user of electricity, our industry adds a voice that has not been heard in the debate on acid rain.

The U.S. aluminum industry is preeminent in the world. We are today, however, faced with significant challenges from international competitors. These challenges are directly affected by the direction of U.S. Government policies. First and foremost are policies concerned with energy costs. Proposed legislative approaches to the acid deposition issue will add tremendous costs to electrical generation.

Electricity costs represent about one-third of the cost of producing aluminum. On average, it takes 7.5 kilowatt-hours of electricity to make a pound of aluminum. Based on 1982 data, the average U.S. cost of electricity for aluminum production was estimated to be 2.4 cents or 24 mills per kilowatt-hour, and in the last year this cost has climbed even higher. Our free world competitors, in contrast, pay an average of 1.7 cents or 17 mills per kilowatt-hour. Some foreign smelters, including Canadian smelters, pay as little as 3 mills per kilowatt-hour. Foreign smelters thus already hold a large competitive advantage in terms of this major component of the cost of producing aluminum.

Power costs have a direct impact on aluminum capacity utilization worldwide and, therefore, on jobs associated with it. With a 7-mill disadvantage compared to free world competitors, capacity utilization during the recent recession was 20 percent less than most others in the free world producing nations.

An analysis conducted by the Aluminum Association shows that proposed controls to reduce SO_2 emissions by 8 million tons could increase the cost of electricity to some aluminum plants in the 31-State region by more than 10 mills per kilowatt-hour. This means an additional 7.5 cents per pound to the cost of producing primary aluminum, thus making these plants noncompetitive both domestically and internationally.

Approximately 60 percent of the aluminum industry's capacity in the United States is located in the 31-State region. Ninety percent of that capacity depends on coal-fired electricity and will be directly affected by increased costs resulting from proposed SO_2 reductions.

We in the aluminum industry are proud of our environmental record. We are sensitive to the need for environmental protection and are in fact leaders in this effort. I am personally committed to environmental protection. I am a long-time member of the Audubon Society and as a young man spent many weeks in the summer canoeing in the Adirondacks.

Let me focus briefly on how acid deposition controls would damage my own company. Kaiser Aluminum owns and operates an integrated aluminum smelter and rolling mill facility in Ravenswood, W. Va., employing over 2,900 people at full operation. Based on the best information we can obtain, we estimate that an increase of 25 percent or more in electricity prices to Ravenswood would result from passage of pending acid rain control legislation.

The Ravenswood facility now constitutes Kaiser Aluminum's largest production complex in the world. The smelter portion was reactivated in the latter half of 1983 after an 18-month closedown due to excessive production costs. Kaiser Aluminum and the United Steelworkers of America negotiated major revisions of work practices and other agreements during this period to increase labor productivity and to return the plant to competitive status. Increases in Ravenswood's electricity rates approaching the magnitude estimated would nullify the labor productivity and other production gains made by Kaiser and the Steelworkers through sacrifices by both labor and management.

The future of the Ravenswood smelter is unquestionably linked to the acid rain issue. Under the currently proposed legislation, and depending upon how the emission reductions are implemented, the smelter at Ravenswood would at best be swing capacity operated only when aluminum demand is high but more likely doomed to permanent closure.

I will close by saying we in the aluminum industry do not believe you will recommend legislation designed to solve one problem by creating another of intolerable proportions. We support the direction taken in legislation proposed by Senator Randolph, Senator Byrd, and Congressman Rahall. The aluminum industry strongly urges this committee and all of Congress to carefully factor in the potential loss of jobs, the loss of economic wealth, and the loss of basic U.S. industry as it considers acid rain legislation.

Thank you again very much, Senators, for granting me the opportunity to testify.

Senator STAFFORD. Thank you very much, Mr. Hutchcraft.

Let me say to you and to all of the witnesses who are scheduled—and there are 20 witnesses scheduled for this morning—that in every case where you have provided the committee with a written statement we will make the written statement a part of the record in full. In view of the numbers of witnesses, however, we would, as you have been told I think, appreciate a verbal summary of your statement not to exceed 5 minutes. I will put you on notice that the Chair is going to start watching the clock while each witness is up at the witness table.

I don't have any questions, Mr. Hutchcraft. I appreciate your candid testimony. There may be written questions from other members of the committee who are not here this morning and I would ask the witnesses that we will hear, if it is agreeable to them, if the members do have questions and they submit them in writing if you would be willing to respond to them at your earliest convenience.

Mr. **Hutchcraft**. Mr. Chairman, we would be pleased to respond for the record to any questions you may have.

Senator **Stafford**. Thank you very much. I know Senator Randolph may have some.

Senator Moynihan.

Senator **Moynihan**. I think that is the one way we are going to be able to get through our agenda. We do have questions and we appreciate your candid testimony, Mr. Hutchcraft.

Mr. **Hutchcraft**. Yes, sir.

Genator **Stafford**. Again in the interest of expediting matters, I wonder if the next four witnesses—Mr. George Davis, Mr. George Lawrence, Mr. Harry Buchanan, and Dr. Leon Green—would be willing to come to the witness table.

Good morning, gentlemen. The Chair would propose to take you in the order in which he announced you; that is, first Mr. George D. Davis who is the executive director, the Adirondack Council, Elizabethtown, N.Y.

Mr. **Davis**. Thank you, Senator.

Senator **Moynihan**. Mr. Chairman, may I——

Senator **Stafford**. You may indeed.

Senator **Moynihan**. Mr. Chairman, I take the opportunity not just to welcome Mr. Davis today, who is a great friend of our State but just to point out the Adirondack Park, and it might seem a rather small enterprise but it is worth reminding ourselves that it is larger than the State of Massachusetts, it is three times the size of Yellowstone. I am not speaking about an urban patch of green, we are talking about a region.

STATEMENT OF GEORGE D. DAVIS, EXECUTIVE DIRECTOR, THE ADIRONDACK COUNCIL, ELIZABETHTOWN, N.Y.

Mr. **Davis**. Thank you, Senator. I am glad you said Massachusetts. I usually say it is larger than the State of Vermont but I think that today this would not have been appropriate.

Senator **Stafford**. I thought we got safely by that.

Mr. **Davis**. Senator, my education and work experience have been in the fields of forestry and natural resource management. I would be delighted to answer any questions that you may have in writing.

The council is an organization with 3,000 individual members but it also represents a coalition of conservation organizations with a membership of more than 600,000.

The 120,000 permanent residents of the Adirondacks and the 9 million-plus yearly visitors to the park have plenty of reason to be alarmed; this magnificent area has already lost, as you are well aware, 212 of its lakes to acid rain and 256 more lakes are presently classified as endangered. The terrestrial and the human health effects of acid rain are also important. Although less well known than the aquatic effects, their potential for damage is even greater. Studies throughout Europe show significant damage to their forests and the same appears to be happening in the Adirondacks, in Vermont, and elsewhere in our country.

It is perhaps ironic that the Adirondacks, a region renown for its naturalness, should have been the first area in the United States to clearly show the devastating effects of acid deposition. But although the Adirondacks may have brought the issue of acid rain home to many of us, it can now be shown that the Adirondack experience was merely a harbinger of things to come elsewhere.

We are sorely disappointed in the administration's refusal to call for an acid rain cleanup program this year; instead they stall by calling for more research. The scientific debate over acid rain impacts should have ended last year with conclusive reports from both the National Academy of Sciences and the President's own panel of scientists. It is now time to focus on control programs. I trust that the Senate is ready to move forward and fill the leadership gap left by the administration in this important area.

Senate bill 768 seeks to reduce the annual emissions of sulfur dioxide by 8 million tons by 1995 supplementing this mandate with an emissions cap. The result of these emission controls would be a 35-percent reduction in the 1980 level of emissions in sulfur dioxide.

The 1983 report of the National Academy of Sciences concluded that a 50-percent reduction in sulfur dioxide emissions is needed to prevent further damage by acid deposition. Even this would not bring the rate of acid deposition down to a level that can be adequately buffered by all soils, but it would be a major step forward.

In light of the scientific analysis of acid rain impacts, the Adirondack Council, while applauding the committee for its fine work in developing Senate bill 768, respectfully urges you to increase the required annual sulfur dioxide reduction to at least 12 million tons and to reach that objective within 10 years. The technology exists, the public support exists, we need only your determination, direction, and leadership.

In testimony late last year before Representative Waxman's Subcimmittee on Health and the Environment, the Adirondack Council supported provisions of House bill 3400 that would require the installation of scrubbers. We did so because we believe this is a feasible method to protect jobs and regional employment integrity. It would temper employment shifts from high sulfur coal-producing regions to low sulfur coal regions.

Now there may be other means to avoid potential employment impacts and if so we are certainly open to them. As environmentalists we are concerned with the total environment: human and natural resources. It is difficult, if not impossible, to be environmentally aware and at the same time unemployed.

A recent poll of New York State residents conducted by researchers for the State University of New York and our department of environmental conservation showed, not surprisingly, that they are overwhelmingly in favor of comprehensive acid rain controls. The surprising element was that even though New York State residents are paying some of the highest electric bills in the United States they are willing to pay more if it will help control acid rain. This point has been made repeatedly by public opinion polls; the people of this Nation are willing to pay to have clean air and clean water; 1984 is the year we must move ahead on acid deposition control. We cannot afford to further endanger our Nation's health, water, forests, and soil productivity. The Adirondack Council is pleased to be given this opportunity to testify on Senate bill 768. We commend Senator Stafford and Senator Moynihan and support their untiring efforts to move toward legislation this year that would help protect this planet from the insidious menace of acid rain.

Thank you.

Senator STAFFORD. Thank you very much, Mr. Davis.

Now we will be pleased to hear from Mr. George H. Lawrence who is president of the American Gas Association to be followed by Mr. Harry W. Buchanan.

STATEMENT OF GEORGE H. LAWRENCE, PRESIDENT, AMERICAN GAS ASSOCIATION

Mr. LAWRENCE. Thank you, Senator Stafford, Senator Moynihan.

I represent 300 natural gas distribution and transmission companies. We presently have a great supply of natural gas and we expect to have it for a great number of years. Natural gas is generally conceded to be our cleanest burning fuel, it does not pollute air, land, or water.

I am not here posing as an expert on acid rain either as to its existence or its problems. We are neither proposing nor opposing Federal control strategies, but we do have a suggestion that we think will work economically, physically in reducing sulfur oxide emissions. That is the blended or select use of gas with coal or with high sulfur oil, in which we blend the clean burning qualities of natural gas with either high sulfur or low sulfur coal or with oil.

We believe that the most efficient strategy for a particular plant depends on the factors at that plant. As long as environmental goals are met, it makes sense to let the plant operator choose the strategy that best fits the plant. Select use of gas with coal, low sulfur coal blending, coal washing, scrubbers, and other strategies could each have a place.

With select-use the cost of SO_2 reductions can vary from $50 per ton to over $1,000 per ton in some places, but generally it falls in a range of $200 to $400. I think testimony before this committee indicates that scrubbers can clean coal at a cost of from $250 to as much as $2,000 per ton. Select use is a very flexible control strategy that can be combined easily with other technologies. For example, select use of gas with coal washing could, we think, reduce SO_2 reductions by as much as 50 percent or more while using 70 percent Eastern high sulfur coal. Another technique—low sulfur coal washing—would reduce Eastern coal consumption to as low as 25 percent. I think select use addresses the job loss point that the previous witness and Senator Randolph have discussed.

A special advantage of select use is that it can be implemented quickly and with very low capital costs. Not only would it reduce SO_2 now but it could also be used to study the cause and effect relationship between emissions and changes in the acidity of rain and lakes. This strategy avoids the long lead times and large investments for major pollution control equipment as well as avoiding any economic dislocations from high to low sulfur coal switching. It also preserves future SO_2 control options so that, if research does pinpoint acid rain sources, flexibility is retained as to the optimum permanent course to pursue.

If we do choose select use as an option, then 1 trillion cubic feet of gas per year could, reduce in the range, of 2 million tons of sulfur oxide and combining that with coal washing could increase it the SO_2 reduction to as much as 4 million tons per year of sulfur oxides. Presently there is 3 to 4 Tcf excess gas deliverability available and we think as we move into our deregulated period for new gas exploration that that good supply will continue.

In summary, we think that select use of gas has many benefits for plant operators and for energy consumers as a whole. We think that some benefits are:

It can maximize the use of eastern coal and minimizes the economic and social dislocations;

It avoids plant derating, increased solid waste, increased particulates, and railroad transportation problems associated with straight coal strategies;

It offers prompt emission reductions since new equipment or plant modifications are minimal in most cases;

It can buy the Nation valuable time since select use can be used temporarily to reduce emissions quickly while research is ongoing; and

It avoids the high capital costs of a mandatory scrubber program.

We think, Mr. Chairman and Senator Moynihan, now is the time to take advantage of the environmental benefits of our cleanest burning fossil fuel, a long term adequate supply of which appears very attainable. At the present time there is an overcapacity of natural gas and the use of this gas now can alleviate some of our current gas surplus and take-or-pay problems.

Thank you very much.

Senator **STAFFORD**. Thank you very much. We really appreciate your testimony.

Now we invite Mr. Harry Buchanan, vice president, Celanese Corp. of New York, immediately followed by Or. Leon Green who is vice president of the Clean Coal Coalition of Washington, D.C.

STATEMENT OF HARRY W. BUCHANAN, VICE PRESIDENT, CELANESE CORP.

Mr. **BUCHANAN**. Mr. Chairman, I appreciate being here today. My name is Harry Buchanan. I am vice president of Celanese Corp., a major producer of chemicals, fibers and specialties and the world's largest producer of methanol.

I appear today not as an expert on acid rain or to propose a total solution to this issue, rather I wish to review for the committee a growing body of evidence that suggests the use of methanol as an alternative fuel in a number of different applications could play a role in this Nation's overall acid rain strategy. Specifically, methanol—when used as a fuel—could help reduce emissions of nitrogen oxides and, to a lesser degree, sulfur dioxide, both of which have been identified as the major precursors of acid rain.

We feel that the favorable environmental benefits of methanol are key reasons for its growing popularity as a transportation fuel. Let me describe in more detail some of the ways in which methanol can reduce emissions of nitrogen oxides and sulfur dioxide and, hopefully, contribute to the control of acid rain.

At this moment a General Motors methanol bus, the first of its kind in the United States, is in the first phase of a year-long evaluation program in revenue service across the Golden Gate Bridge in San Francisco. Throughout California, the State's 506 new factory-produced Ford methanol Escorts are being used to conduct State and local business. These cars are being fueled at an increasing number of methanol gas stations stretching from San Diego to San Francisco. In the private sector the Bank of America announced the successful conversion of over 200 of its fleet vehicles to run on NEAT methanol. NEAT methanol is 90 percent methanol and 10 percent gasoline. They have now logged several million miles and report excellent results.

On the national level, the EPA's Office of Mobile Sources in Ann Arbor, Mich., is continuing to study methanol as a fuel. The agency's findings conclude that "with respect to nitrogen oxide and particulate emissions, methanol-fueled vehicles offer the greatest benefits."

Furthermore, any hydrocarbons that are produced are believed to be much less photochemically reactive. It is the latter, of course, which are said to contribute to urban smog.

Furthermore, methanol fuels also have the potential to successfully reduce air pollution from stationary sources, such as various types of gas turbine electrical generators. Tests conducted at a major utility company have shown that there is a significant nitrogen oxide reduction over natural gas in load-following utility turbines. There is also preliminary evidence that methanol in stationary boilers through a process known as overfiring could have a significant enviromental impact.

Overfiring is a process where methanol is burned in small quantities over a fuel such as normal utility-grade fuel oil. The net result is reduced emissions, particularly nitrogen oxides. There are various technical reasons for this effect. First, methanol itself is nitrogen and sulfur free. More importantly, since methanol burns at a much cooler temperature, it tends to reduce nitrogen oxides.

Obviously what is needed now is a large-scale overfiring demonstration in an oil-fired burner to analyze actual field test results. Any Federal action and leadership in this regard would be a major step toward proving the potential beneficial environmental impact of methanol overfiring in large utility and industrial boilers. There is a body of opinion that believes the same overfiring benefits achieved by burning methanol in an oil-fired burner could have a beneficial environmental effect in coal-fired burners. This theory should be explored for its potential benefit in nitrogen oxide and sulfur oxide reduction.

Mr. Chairman, the question most everyone raises at this point is: What's holding methanol back?

I think that part of the answer is that the environmental and performance advantages of methanol aren't well known and there is a widespread—granted, mistaken—belief that there isn't enough methanol available for fuel. Then there is the normal resistance anyone would expect to find when changes to the traditional transportation and fuel systems are proposed. We're working hard on all of these problems.

But there is a second part to the answer which needs Government attention. A number of Federal laws and regulations currently make it difficult for methanol to compete effectively against the traditional transportation fuels. Quite unintentionally, these restrictions impede the use and development of methanol as a fuel.

President Reagan took a major step forward very recently when he appointed a 15-agency task force consisting of the Assistant Secretary level staff to study the legal barriers holding back the development and testing of methanol as a fuel in the United States. We at Celanese applaud the President's leadership and we are extremely encouraged by the overall support shown by this administration. The EPA, too, is vigorously examining these issues and we're optimistic about their efforts to test and measure the environmental effects of methanol in some of the applications I discussed.

In conclusion, I will outline several steps which we believe the Federal Government can take to facilitate the use of this clean-burning fuel. First, we recommend the removal of certain provisions of existing law and regulation which inadvertently inhibit the development of methanol as a transportation fuel. These include:

Equalizing Federal motor fuels taxes so that methanol is taxed on an energy equivalent basis with gasoline and diesel fuel;

Modifying existing regulations to facilitate certification of methanol vehicles; and

Modifying corporate average fuel economy standards to accurately reflect the fuel economy of methanol.

Second, we recommend Government participation in certain limited research, development, and demonstration activities to develop methanol's fuel use as a method of nitrogen oxide reduction that would be of assistance in an acid rain control strategy.

Thank you.

Senator STAFFORD. Thank you very much, Mr. Buchanan.

Dr. Green.

STATEMENT OF LEON GREEN, JR., VICE PRESIDENT, CLEAN COAL COALITION, WASHINGTON, D.C., ACCOMPANIED BY MICHAEL J. ZIMMER, LEGAL COUNSEL TO THE COALITION

Dr. GREEN. Thank you, Mr. Chairman.

My name is Leon Green, Jr., president of Energy Conversion Alternatives, Ltd., and vice president of the Clean Coal Coalition. I am accompanied at the press table by Michael J. Zimmer, a partner in the Washington, D.C., law firm of Wickwire, Gavin, and Gibbs, and legal counsel to the coalition.

I have a short statement to read here and a more detailed statement to be submitted for the record.

The coalition is an organization of interested companies and organizations dedicated to the development of Federal/State policies which encourage the use of flexible, least-cost emissions control strategies under the Clean Air Act, particularly for the reduction of acid rain. Companies representing a variety of viewpoints drawn from the industrial user, electric utility, gas utility, equipment manufacturing, coal processor, engineering and consulting communities comprise the Clean Coal Coalition.

Mr. Chairman, we share the dismay expressed by this committee at the administration's unwillingness to initiate a program for control of sulfur dioxide emissions which lead to acid precipitation on the grounds that the atmospheric processes involved are not fully understood. The administration does not refuse its dinner because it does not fully understand the process of digestion, yet it pleads ignorance as an excuse for inaction on environmental protection. To term this position "not irresponsible" is to damn it with very faint praise indeed. Corrective measures employing well-known commercial practices which could significantly decrease SO_2 emissions and which need not require any massive scrubber installations and tax schemes to pay for them could be initiated immediately if the call arises.

The coalition urges the Congress to make revisions to the Clean Air Act to remove the language stating limits for sulfur dioxide emissions in terms of percentage reductions which effectively mandate post-combustion cleanup only and exclude more attractive, cost-beneficial alternatives. In this regard the plant operator should be entitled under the act to determine which control measures and combination thereof would be most effective and sensible on the basis of the site specific characteristics of his plant. Flue gas desulfurization or scrubbing is but one sulfur dioxide emission control option among several and by far the most costly.

Federal statutory requirements should not operate to dictate FGD as the only emission control option but should preserve appropriate flexibility for use of other less costly emission control strategies. Comparable changes would also be necessitated in the Internal Revenue Code to correct its bias favoring post-combustion cleanup options while effectively excluding precombustion options for incentives offered by tax credits, rapid amortization and bond financing.

Finally, we would focus congressional attention on the fact that conventional coal cleaning is and should be recognized as the most cost-effective first step toward control of sulfur dioxide emissions. Effective cleaning operations can be profitable if energy now lost is recovered by burning the waste in sulfur-capturing fluid bed boilers. Early commercial introduction of economical coal/water fuels using deeply cleaned coal can also further increase the initial contribution of conventional coal cleaning. This approach can be easily coupled with selective use of natural gas, as mentioned by Mr. Lawrence, to augment cleaned coal as a cost-effective, secondary step toward control of sulfur dioxide emissions.

From the data presented in our written statement on reduction of SO_2 emissions achievable by conventional cleaning of all utility coal burned in eight States, or 2.5 million tons, we estimate that extension of this practice to all coal burning States—even low-sulfur Western coal requires deashing—plus deployment of technology for cogeneration by waste burning, use of coal/water fuel and select use of gas could approach the goals guiding the deliberation of this committee while minimizing sole reliance on scrubbing and fuel searching options.

Thank you.

Senator STAFFORD. Thank you very much for your statement.

Thank all of you for your cooperation in staying within our unfortunate time confines.

Mr. Buchanan, I was intrigued by your testimony and I would ask you just one very brief question and that is with respect to methanol: Can you produce it in quantities to take care of the really large electrical generating utilities in this country?

Mr. BUCHANAN. Senator Stafford, I think I would like to answer that question two ways if I may very quickly. One is currently North America is over 80 gallon excess capacity at the current time. Worldwide is considerably more than that. As you go down the pike there are many countries in the third and fourth world who are turning to our country, who have remote natural gas that plants like the World Bank has outlined could be built and at that point you could have up to 25 billion gallons per year of methanol.

I think in summary there are plenty of opportunities for methanol as a fuel. Just one particular one: If you fuel all the buses in the United States like out in California with methanol, it takes 2 billion gallons. Now to a New Yorker that means there is no smoke on the streets. A methanol bus does not smoke. I think in the current time to the New York bus program that might be very helpful.

Senator MOYNIHAN. I wonder, Mr. Chairman, if I could ask of Mr. Buchanan—his testimony was fascinating—would you just let the committee know about the differential in taxation rates because that is something which we on the Finance Committee would want to address directly. I take it, in terms of fuel energy equivalent, methanol is taxed at a higher rate.

Mr. BUCHANAN. That is correct, sir, because a gallon of methanol has approximately half the energy as a gallon of gasoline or diesel and the taxes are based on a per gallon basis.

Senator MOYNIHAN. Well, that is dumb, but a lot of the IRS Code is dumb.

Mr. BUCHANAN. Well, yes, sir. I believe in this. I mentioned California. California has made that change for the State and I believe our cooperation and others have tried to present this idea to various Members of the Congress and hopefully it will go through. It is a very necessary thing particularly since those buses not only do not smoke, sir, they put out about 60 percent less nitrogen oxides, which is very important in congested areas.

Senator MOYNIHAN. Well, at least one member of the Finance Committee comes from a wood producing State as opposed to an oil and gas producing State so you have some agreement.

Mr. BUCHANAN. Thank you, sir.

Mr. LAWRENCE. Could I speak to that?

Senator MOYNIHAN. Yes.

Mr. LAWRENCE. In the natural gas industry we have some compressed natural-gas-fueled vehicles that Ford Motor Co. and Alcoa, along with our companies, are interested in. We think they are going to make a great contribution to urban pollution control reduction. I would not quarrel with the comments about the lower NO_x from methanol, but methanol is a manufactured product and when you manufacture it from coal; as you indicated, you lose about 50 percent of your energy; from natural gas you lose about 30 percent. Now, what we are saying is let the plant operators make these choices economically, efficiently, and considering the need for air-control standards I believe the industry desires.

Senator STAFFORD. Thank you, all four of you. We appreciate it. I think that three of you have pretty much made the argument for flexibility and how industry might want to achieve reduction of sulfur oxide emission, and I read Mr. Davis as supporting the larger reduction in sulfur oxide emission. The committee has the working papers and the committee has the options for 10 and 12 million tons, and I think it comes down to the committee's judgment what is viewable as to what would be the best thing and we will have to make that judgment in the next few weeks.

Gentlemen, thank you very much indeed.

Senator MOYNIHAN. Mr. Chairman, I have to go to an Intelligence Committee briefing on defense.

Senator STAFFORD. All right, sir, of course.

We will now invite the next four who are listed on our sheet: Mr. William G. Karis, Dr. Jay B. Kennedy, Dr. Ely Gonick, and Ms. Julia Holmes and Richard E. Ayres, who appear together. It would be the Chair's intent to follow the same procedure. We will start with Mr. William Karis, who is vice president, corporate planning, Consolidation Coal Co., followed by Dr. Jay B. Kennedy, who is executive director, Electricity Consumers Resource Council.

Mr. Karis, you are on.

STATEMENT OF WILLIAM G. KARIS, VICE PRESIDENT, CORPORATE PLANNING, CONSOLIDATION COAL CO.

Mr. KARIS. Thank you, Mr. Chairman.

S. 768 and the other emissions reductions bills pending before Congress are predicated on concepts which we believe have little scientific support.

My written statement discusses our scientific objections to the bill, and we have submitted several studies which we believe provide a new perspective on several important issues. I hope the committee will give them careful consideration.

This committee has heard from witnesses who have discussed the economic impacts of S. 768 or its predecessor bills. I will not challenge them today, although several of the studies presented are not consistent with similar economic analyses which we have done. Most of these analyses have focused primarily upon the economic consequences of emissions reductions to utilities and their ratepayers and upon the direct impacts in the coal industry. Adequate attention has not been given to the indirect impact on the coal industry and on local communities. We do agree with these analyses to this extent: The annual costs to utilities and their ratepayers will be in the billions of dollars, and the employment impacts in high sulfur coal producing areas will exceed over 100,000 jobs.

We believe that these analyses have only scratched the surface in analyzing the costs of the bill currently under consideration. To illustrate this point, I would like to offer some rough estimates of several costs that have not been considered. For example, the mosts of closing existing high sulfur coal mines as a result of passing S. 768 have been ignored totally. We estimate that it costs approximately $5 per annual ton of capacity physically to close a coal mine. This includes the costs of sealing the mine, removing surface structures, and reclaiming the surface areas disturbed during the mining process.

In addition, there are several major ongoing liabilities including pensions, Federal and State black lung payments, and workers' compensation that would have to be funded from alternative sources after the mine is closed. For a 1-million-ton per year mine, the present value of these liabilities would be approximately $30 million. Thus, the costs for each million tons of high sulfur production capacity that is shut down because of S. 768 would be approximately $35 million. These values are based on Consol's experience and may be different for other companies, but I believe the order of magnitude is correct.

Consider also the loss in capital investment and recoverable coal reserves of prematurely closing existing high sulfur coal mines.

Senator **STAFFORD**. Could you summarize?

Mr. **KARIS**. Sir, I am almost done with my statement.

My point in all of this, Mr. Chairman, is not to lay before the committee an exact accounting of the indirect costs of S. 768 but rather to suggest that we have only just begun to recognize the economic consequences of such legislation. The fact is that S. 768 goes far beyond the scope of any of the cost studies considered thus far. Indeed, the economic consequences of cost increases in the energy sector are so pervasive that I doubt any model, no matter how complex, can predict the full impact on society. I hope this committee will keep that in mind in its deliberation.

Senator **STAFFORD**. Thank you very much.

Now we will hear from Dr. Jay B. Kennedy, executive director, Electricity Consumers Resource Council, to be followed by Dr. Ely Gonick.

STATEMENT OF JAY B. KENNEDY, EXECUTIVE DIRECTOR, ELECTRICITY CONSUMERS RESOURCE COUNCIL

Mr. **KENNEDY**. Thank you, Mr. Chairman.

My name is Jay B. Kennedy and I represent a group of industrial firms gathered together in an organization we call Elcon, the Electricity Consumers Resource Council. Our interest in acid rain is not because we are sellers of any particular fuels for utilities nor any other commercial interest in that particular sense. Our firms produce a variety of products—automobiles, steel, aluminum, fibers, chemicals, a brewery is one of our members. Their interest in the subject of acid rain legislation is that they buy huge amounts of electricity. Our members, 16 of them, purchase approximately one-twentieth of all the electricity marketed in the United States, so electricity to us is a very important subject.

Industrial electicity consumers are concerned about the environment. We expect to pay our fair share of any necessary program. However, we are forced to deal with the facts of the marketplace. During these times of increasing competition in world and domestic markets, we must be certain that any additional cost imposed on U.S. industry generates a benefit at least equal to that cost. This is really the thrust of our testimony, Mr. Chairman.

We do not oppose any of the bills under consideration nor do we support them. Our concern is that we have seen no evidence what benefits will be derived at any level of SO_2 reduction: It is really a pretty basic question from our point of view.

There are many problems in the country that need to be addressed. The question is which ones to address and how much of our resources to devote to the particular problems. In other words, how much is it worth? It is not sufficient to say that there is a problem that must be addressed. We recognize that, we admit there is an acid rain problem. Anyone will admit that. The question is how much of a problem and how much do we spend to offset it.

We estimate the cost to the industry to be a 20-percent rise in electric rates on a State average basis as a result of a 10-million-ton reduction and as much as 50 percent on increase in rate particular utility systems. These costs will place U.S. firms at a disadvantage. To give you some idea of the impact of these costs, for some of our firms electricity represents 70 percent of operating expense. A mill increase in rates here and a mill there is no small sum when you are talking about the quantities of electricity I'm referring to.

We are not commenting on the method of collecting the funds to support a particular program. The important point at present, from our point of view, is to determine the benefits from various levels of SO_2 reduction and then establish the one we are willing to buy. Later we can consider the best method to collect the dollars to fund that program and we would be happy to address that at the appropriate time.

We are somewhat concerned that there certain factors have been neglected in all the discussions on acid rain options and alternatives. There is a serious question as to the impact acid rain legislation might have on the demand for and the price of OPEC oil. Certainly, utilities would be encouraged to continue burning oil when they have the capacity to do so rather than spend huge sums on new units or plant modifications. This is of particular concern, I think, given the fact that the Department of Energy for some years now has been heavily involved in oil backout and trying to encourage utilities to get off of oil and on to coal. This doesn't mean that we should not have acid rain legislation. However, an increased dependence on OPEC oil, combined with a lack of enthusiasm for nuclear units might jeopardize the electricity supply system in the United States in the near future.

You have heard substantial comment by Elcon and others as to the dollar cost of an emissions control program. The important issue, we feel, is the real cost to the United States and its standard of living if tens of billions of dollars' worth of resources are used to control acid rain with no assurance of an equivalent real benefit. Those resources have alternative uses in the private and public sector for schools, medical care, roads, and so forth. If used to control acid rain, then by definition they are not available for other real income purposes. It is this cost that we think is important and it concerns us. We are willing to participate in the settlement of this issue, however we do feel someone has an obligation to give us some idea of the kind of benefits we can expect so we can decide which program is the best to adopt.

That is my testimony. Thank you.

Senator STAFFORD. Thank you very much, sir.

Now Dr. Ely Gonick, senior vice president for Technology, International Paper Co., to be followed by Ms. Julia Holmes, League of Women Voters.

Dr. Gonick.

STATEMENT OF ELY GONICK, SENIOR VICE PRESIDENT FOR TECHNOLOGY, INTERNATIONAL PAPER CO.

Dr. GONICK. Senator Stafford, thanks for giving me the opportunity to appear before the committee today. I am senior vice president for Technology for the International Paper Co.

International Paper Co. owns 6.6 million acres of land in the United States, 1.6 million acres of which are in the Northeast and 1.1 million of those are in the State of Maine. We are the largest industrial landholder in North America. The health of our trees is important to our company and to all of the paper industry's operations whether they be in Vermont, Maine, New York, Louisiana, or Arkansas.

There is a widespread belief that acid rain has increased in recent decades and is harming the sensitive environments of northeastern United States and Canada by acidifying the forests and waters. The acid rain originates from the combustion of fossil fuels to form sulfur and nitrogen oxide which later transform to acids in the atmosphere and deposit as rain, snow, fog, or dust.

With the advent of very tall smoke stacks, particularly on coal-burning utility boilers, the emissions now can now carry much farther than before and cross State and national boundaries.

Legislation to reduce emissions has been introduced in Congress. If enacted, operating costs are estimated to range at about $2.5 to $5 billion per year depending on the reduction required.

The legislation presumes that by reducing emissions the Northeastern U.S. environment will return to an earlier healthier condition. The legislation has three basic assumptions: No. 1, that current atmospheric models can predict how changes in emissions of sulfur dioxide and nitrogen oxides in one area will change the amount of acid deposited in other areas; two, that acid deposition has a major influence on acidification of the environment; three, that raising the pH of acid rain in the Northeast from the current 4.1 to 4.3 to 4.7 to 4.8 will significantly reduce the harm to the environment.

There is serious question whether acid deposition is really an important factor in acidification of the environment. Many scientists believe that the decomposition of forest litter, particularly from conifers, is the prime source of acidification. They note that: As much as 90 percent of the acid in the forest environment comes from the humus and that elimination of acid emissions would only raise pH of runoff by 0.04 to 0.08 pH unit, hardly enough to matter.

In western Douglas-fir areas where rainfall pH is 5.3 to 5.6 runoff pH is 4 indicating that even when rain contains little acid, runoff can be very acid.

Ten times as much acid is generated per year by natural biological processes in the northwest forests as would be contained in pH 4 rain/year.

Although aluminum solubilized by acid rain has been cited as toxic to trees based on studies in the Sollingen forest in Europe, the concentrations are estimated to be 2 parts per million far below the 100 parts per million, which some results have shown are required to show toxic effects.

Based on meteorological data drought rather than acid rain is a much more likely cause of stress to the red spruce at Camel's Hump, in the New Jersey Barrens.

Data based on fossil studies in lake sediments show that some lakes in the Adirondacks were acidified 2,000 to 10,000 years ago when fir and hemlock moved into the area.

Land use changes in Scandinavia and the United States also suggest a return to more acidic conditions as more acid type vegetation supplants grasses and deciduous trees.

No scientific basis now exists to show that acid deposition is detrimental to the U.S. forests. The trees in Europe which are reported to be dying in the Sollingen forest and the Harz Mountains are in areas which receive approximately 20 to 50 times the sulfur input as acid rain provides to northern New England.

Our own studies show that the litter and soil under the conifers in Maine on a range of growing sites has a pH of approximately 3.2 or 10 times as acidic as acid rain, 44 percent of the State is covered with conifers!

Senator STAFFORD. Doctor, I am afraid your time has expired. Could you summarize?

Mr. GONICK. Yes.

It is clear that nature is producing far more acid in these regions than manmade sources are depositing. As a consequence of that, I think we need to defer action on costly legislation to reduce emissions until we know whether they really cause harm. Mr. Ruckelshaus outlined a research program in his testimony before this committee, which should provide that scientific information, and I endorse that program.

Thank you.

Senator STAFFORD. Thank you.

Ms. Holmes.

STATEMENT OF JULIA HOLMES, ACTION DIRECTOR, LEAGUE OF WOMEN VOTERS OF THE UNITED STATES

Ms. HOLMES. Thank you, Mr. Chairman.

I am Julia Holmes, action director of the League of Women Voters of the United States. I am testifying today on behalf of a quarter million league members and supporters in over 1,300 communities in every State across this country.

Our message to you today is very simple. Acid rain is a national problem that demands a national solution. We know the causes of acid rain and we know how to control it. The damages caused by acid rain continue each day that the Congress delays action.

Last week EPA Administrator Ruckelshaus testified before this committee that more research is needed before a control program can be initiated. This position is untenable in light of the conclusions of the National Academy of Sciences and the White Office of Science and Technology policy that immediate control action is warranted. While more research is always desirable on complicated problems, it is irresponsible to ignore the body of research that tells us the problem must be solved.

The administration's research-only posture makes it incumbent on the Congress of the United States to act and act now to reduce the manmade pollution that causes acid rain. We know the environmental effects of acid rain are cumulative and irreversible. We know the impacts extend through much of the Eastern half of the North American continent. We know the time has come to begin action to reduce emissions by 50 percent in the Eastern United States within 10 years.

I would like to emphasize in my testimony today the fact that the acid rain problem is not confined to just the Northeastern States. Scientists are finding that abnormal acidic precipitation is occurring over large geographic regions in Eastern North America, that the sensitivity of land and water bodies to acid rain is widespread and that the serious environmental impacts of acid rain are expanding.

Acid rainfall has been measured in every State east of the Mississippi River. On the average, rainfall in the Eastern United States is 20 to 40 times more acidic than normal. Highly acidic rainfall has been observed in Southeastern States—notably, Florida, Virginia, Texas, and North Carolina; in the Northern Plains States of Minnesota and Wisconsin; and in the mountainous regions of the West. Southern California is experiencing the phenomenon of acid fall with pH values of 1,000 to 2,000 times more acidic than normal. The worst episode of acid precipitation ever recorded occurred in Wheeling, W. Va., in 1978, when rain was with a pH factor of 2.0, more acid than lemon juice, was monitored.

The effects of acid rain on aquatic resources are well documented. New York and New England are hardest hit, but other areas of the country, such as the Midwest and the Southeast, have been identified where water quality and aquatic life are affected. There are threatened resources in Minnesota and Wisconsin, North Carolina and northern Florida, New Jersey, and Pennsylvania and even in the Great Smoky Mountains of Tennessee. New studies show that lakes in the Western United States, particularly Colorado and Washington, are being damaged by acid rain. In these and other areas parents and grandparents may be deprived of the real joy of sharing a favorite fishing spot with the next generation of children.

The impacts of acid rain are not limited to aquatic resources. Forest productivity is also at risk. If the preliminary evidence is borne out, the economic losses in the Southeastern United States, where forestry will be an increasingly important industry in the future, could be substantial.

Agriculture is another area where widespread acid deposition could have economic implications. Startling findings have been reported from preliminary research on two major crops, corn and soybeans, that have tremendous economic importance. Losses could be concentrated in areas with the largest production of these commodities, such as Ohio, Indiana, Illinois, Michigan, and Wisconsin.

Acid rain has public health implications as well. In addition to the direct harm caused by breathing the pollutants that cause acid rain, there is increasing evidence that the corrosive elements of acid rain are entering water supplies.

Pollution control programs may be accomplished without major economic disruption. Where there are substantial economic costs, there are also serious economic consequences to society if steps are not taken.

I want to conclude by saying that the public is strongly behind this committee's efforts to implement solutions to the environmental scourge of acid rain. Our members' concern is deep and their concern is registered from every point of this country from Michigan to Colorado, from Connecticut to Florida, from Indiana to Texas. I believe that our members' concern reflects public opinion in general. On the issue of acid rain, the public opinion polls are crystal clear. In December 1983, Harris reported that the vast majority of the American people from every region of this country are willing to pay their fair share to reduce the pollution that causes acid rain.

We urge you to go forward with the legislation that will effectively reduce acid rain in the Eastern half of the United States. We urge you to do so with the dispatch that the urgency of the situation demands.

We will be happy to accept any of your written questions.

Thank you.

Senator **Stafford**. Thank you very much indeed, Ms. Holmes.

Thank you all very much for appearing here this morning.

The next four witnesses will be Mr. Thomas Altmeyer, Mr. Richard Ayres, Mr. Edward Sherry, and Mr. John Quarles.

Once again it would be the Chair's intent to go in the order in which I have called your names. Mr. Altmeyer who is vice president, congressional affairs, Mining & Reclamation Council of America, would be first to be followed by Richard Ayres, chairman of the National Clean Air Coalition.

Mr. Altmeyer, again my apologies for the time bind we are in.

STATEMENT OF THOMAS ALTMEYER, VICE PRESIDENT, CONGRESSIONAL AFFAIRS, MINING & RECLAMATION COUNCIL OF AMERICA

Mr. **Altmeyer**. Thank you, Mr. Chairman.

Mr. Chairman, I am Thomas Altmeyer, vice president for congressional and government affairs of the Mining & Reclamation Council of America. MARC is a national association of coal producers and allied industries representing over 200 companies and 32 State and regional coal associations. Through its corporate membership and affiliated associations MARC represents over 3,000 coal operators and industry suppliers nationwide. We appreciate the opportunity to present our concerns to the committee.

Acid rain, considered by many to be one of the major environmental issues of the 1980's, is one of the more complex environmental issues to face the Congress. It would be naive to think that such a complex problem is subject to a simplistic answer. The complexity of the problem is exacerbated by its impact on national energy policy, the potential economic impact on regions of the country and political considerations, both domestically and with neighboring countries.

The basic underlying theme which, MARC believes, should guide congressional consideration of this issue is that a cure should not be prescribed before the disease is understood. This theme was reflected in the testimony of the Administrator of the Environmental Protection Agency before this committee on February 10. In addition to outlining the substantial ongoing research efforts to develop an empirical basis for prescribing a cure, Mr. Ruckelshaus reviewed the significant questions which must be resolved prior to initiating a multiyear, multibillion dollar program.

While no amount of research will ever yield absolute answers, several additional years of research—both into the phenomenon of acid rain and on technologies for more cost efficient reduction of emissions from coal combustion—promise to provide a substantially enhanced information base upon which a sound policy can be based. The major question posed by this approach is do we have time to develop that data base and would it be irresponsible to act in advance of such knowledge.

MARC believes the answer is yes. While I am not a scientist and not qualified to analyze existing research, I believe it is reasonable to say that neither adverse health effects nor adverse effects on agriculture or forests have been documented as an impact of acid precipitation. Also significant is the fact that since 1970 sulfur emissions from stationary sources have been decreasing approximately 10 percent a year under existing law and that, as older plants are replaced by cleaner ones, emissions of sulfur dioxide will begin to decline significantly starting in the next decade.

It is accepted that high acidity levels exist in waters of sensitive regions of the United States and that these areas do have more acidic rainfall. What is not known is whether a reduction in the level of acidity of rainfall in these areas will result in any corresponding change in the acidity level of the affected waters. As reflected by the National Academy of Science's acid rain study, the relative contribution of local and distant sources of sulfur dioxide and nitrous oxide emissions to the pH level of the rainfall and whether the rainfall directly impacts the acidity level of affected waters is not known.

MARC believes, based upon existing knowledge and projected trends of emissions, that we do have time to develop a better information base prior to deciding whether to initiate a control program and that we do have time to develop more environmentally efficient emission reduction technologies rather than mandating the extremely costly retrofit of existing sources.

For these reasons, MARC is opposed to legislative proposals, either separately or as a part of an amendments package to the Clean Air Act, which would impose multiyear reductions on sulfur emissions from stationary sources. MARC is specifically opposed to any federally mandated technology or regulatory requirement on existing sources to reduce sulfur dioxide emissions from stationary sources. MARC believes that the private sector, with its inherent competitive forces, is best equipped to determine the most cost efficient and workable compliance technology to meet emission standards.

Recognizing the problem of acidified waters in sensitive regions of our country and the likely contribution of sulfur emissions MARC supports efforts to expeditiously resolve the scientific uncertainties in our knowledge of the acid rain phenomenon and to immediately address the problems of acidification of waters in sensitive regions through mitigation. These principles are embraced in legislation, S. 766 and S. 454, introduced by the ranking minority member of this committee, Senator Randolph, and the Senate Democratic leader, Senator Byrd, respectively.

MARC believes that given existing scientific knowledge, initiation of a massive reduction program at this time is neither justified nor supportable. Billions of dollars would be required to be expended which may result in no improvement to the problems sought to be addressed. A more progressive course of action would be to address the problem of acidified waters immediately and to aggressively move forward with a research program to develop and demonstrate more cost effective methods to reduce emissions.

Our national energy policy, evolved through the decade of the 1970's, is premised upon utilization of domestic resources as coal for energy production. To meet that goal increased emphasis must be placed on developing precombustion, combustion, and postcombustion technologies through the commercial demonstration stage which permit coal use for power generation with reduced emissions. Through development and implementation of enhanced technologies for the more efficient and environmentally inert use of coal, coal can continue to provide low-cost energy for America's homes and factories for hundreds of years. This course of action will work to simultaneously pursue and achieve both our Nation's environmental and energy policies.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you very much, Mr. Altmeyer.

Richard Ayres, chairman of National Clean Air Coalition.

STATEMENT OF RICHARD E. AYRES, CHAIRMAN, NATIONAL CLEAN AIR COALITION

Mr. AYRES. Thank you, Mr. Chairman.

I am Richard Ayres, chairman of the National Clean Air Coalition. I am here today to testify on behalf of the Natural Resources Defense Council.

Mr. Chairman, the acid rain data has been distorted by a mistaken political paradigm. This paradigm holds that acid rain control will benefit only a few lakes and streams, mostly in the Adirondacks. It also holds that all of the cost of control programs will be in the Midwest but none of the benefits will occur there because no sensitive lakes and streams are found there. Believing this paradigm, many Midwestern politicians oppose acid rain control. Others argue that any control programs should be small and should focus on the sources closest to the affected lakes and should not include controls on Midwestern sources.

Well, Mr. Chairman, this paradigm is wrong. First, controls on acid rain-causing pollutants will produce a wide range of human, ecological, and economic benefits. Second, the largest pollution reductions under the leading acid rain program will occur in the Midwest resulting in major benefits there. Third, a 12-million-ton SO_2 reduction program is needed to fully protect lakes and streams and to increase protection for other resources. Fourth, the sources with the largest impact on lakes and streams, on visibility, on materials, and on human exposure are located in the industrialized areas of the Midwest and the Southeast. These sources must be included in a control program if it is to be effective in achieving broad resource protection benefits.

The National Clean Air Coalition and others have made these points in the past, Mr. Chairman. Recently, however, EPA commissioned a study which strongly supports the arguments that acid rain controls will produce a broad range of benefits. The study conducted by Systems Applications, Inc. [SAI], is still under review at EPA but it was made available to us a week ago. The SAI study calculates that the 8-million-ton, 12-million-ton and Waxman-Sikorski control programs would produce significant improvements in a variety of air quality measures throughout the eastern United States.

A 12-million-ton program would reduce concentrations of SO_2 by 50 percent or more in many areas, reduce wet and dry sulfur deposition from 30 to 50 percent in many sensitive aquatic areas, reduce the sulfur deposition in the Eastern United States most populated areas—which is a good surrogate from materials exposure—by 40 to 50 percent, reduce human exposure to airborne sulfate by 30 to 40 percent in most heavily populated areas, and reduce sulfate-related visibility damage by 30 to 40 percent.

In short, Mr. Chairman, acid rain control is pollution control as well. It produces pollution reductions which will benefit many parts of our human and natural environment. For example, acid rain control would provide a kind of health insurance, one focused on prevention rather than cure.

The SAI study calculates that a 12-million-ton, 31-State program would reduce human sulfate exposures in 1995 by 36 percent. Using an SO_2 health effects function developed by researchers at Harvard and MIT, one can calculate that a reduction in human exposure to sulfates of this magnitude would prevent 12,128 premature deaths each year. Such a calculation is obviously highly controversial and there is no proof that the numbers presented are the "right numbers." However, even if they are overestimated by a factor of 10, the number of lives involved is substantial and I think that is the point.

Pollution reduction benefits are greatest in the States with the largest control obligations, too. The States with the largest control duties under the various bills have been falsely portrayed as the losers in acid rain control. In fact, they would probably be the largest beneficiaries.

According to SAI a 12-million-ton, 31-State control program would reduce annual SO_2 concentrations by 50 percent or more in Illinois, Indiana, Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. It would cut dry deposition of sulfur compounds by 40 percent or more in those areas. It would cut sulfate damages and visibility by 30 to 40 percent and cut human exposure to sulfates by 27 to 47 percent in those States.

The SAI study makes a crude attempt to calculate the monetary value of just one of these benefits, visibility. SAI calculates that the visibility improvements resulting from the 12-million-ton program would be worth $4.2 billion to the residents of the 31-State region and $2.3 billion of that would occur in the 10 mostly Midwestern States I have mentioned.

Senator STAFFORD. Can you summarize at this point?

Mr. AYRES. Yes; I think the rest of the SAI study can be summarized by saying that it shows that a smaller program, an 8-million-ton program, would not pay off in benefits of that magnitude and finally that the Midwestern sources are the primary contributors to damage and are the most efficient sources of control regardless of which of these benefits one is seeking.

Thank you.

Senator STAFFORD. Thank you very much, Mr. Ayres, for your testimony. We appreciate it.

You are to be followed by Mr. Edward Sherry, director of energy supply, Air Products & Chemicals, Inc., Allentown, Pa., speaking on behalf of the National Association of Manufacturers, and he will be followed by Mr. John Quarles, attorney at law, speaking on behalf of the National Environmental Development Association, Clean Air Act Project.

Mr. Sherry.

STATEMENT OF EDWARD V. SHERRY, DIRECTOR, ENERGY SUPPLY, AIR PRODUCTS & CHEMICALS, INC., ON BEHALF OF NATIONAL ASSOCIATION OF MANUFACTURERS

Mr. SHERRY. Thank you, Senator Stafford.

I am Edward V. Sherry, director of energy supply of Air Products & Chemicals, and the chairman of the Electricity Task Force of the Energy Committee of the National Association of Manufacturers.

The NAM is an association of 13,000 manufacturers and as such is well qualified to remind the committee that, in choosing an approach to the problem of low pH of sensitive lakes in the Eastern United States and Canada, the Congress will be making a choice that will have a major effect on the manufacturing segment of our economy. The manufacturing segment employs over 19 million people and is currently operating at less than 80 percent of capacity with over 8 percent unemployment.

This segment is especially vulnerable to costly new regulations. It is just now recovering from a very deep recession and 4 years without growth because of foreign competition, the strong dollar, high unemployment, low operating rates, and restructuring costs.

The ongoing recovery is fragile and in some of the most basic industries it is not yet apparent. Manufacturers and American labor are struggling to improve their efficiency and productivity helping the Nation to regain economic growth.

Certainly, the enjoyment of lakes and the preservation of this country's natural environment are important: material goods are not the full measure of Americans' quality of life. The goods manufacturers produce, however, are an essential part of our environment without which the quality of life in this Nation would be vastly different.

The term "environment" should not be limited to a rural area. The environment for a large number of our people is within the cities where they are employed or where they are seeking employment.

As a result of the recession the United States is well aware of its economic limitations. We cannot simultaneously do everything that seems worthwhile to do. The cost of 4 to 10 million tons of sulfur reduction programs have been estimated to range up to $7 billion per year. If the Congress were to choose for the Nation that this largest sum should be directed to this program, it would be removing from the economy not only the equivalent sum that could have been spent on other efforts but also the multiplier that would have resulted from that portion which would have been invested in creating future wealth and employment.

Choosing to do one thing implies choosing not to do something else. Seven billion dollars additional spending on education; on health programs; on R&D; on new technology; on improving our infrastructure, our roads, our bridges, our railroads; or reducing taxation whereby individuals and corporations could spend where they choose, would have much more effect on improving the quality of life.

Many industries have problems in remaining viable in light of foreign competition, competition for the consumer dollar and competition with each other brought on by over-capacity. You are well aware that these problems have caused numerous plant closings and unemployment in recent years. Our main concern with an acid rain program is its impact on manufacturers' costs to purchase electricity. The portion of the cost impact of acid rain legislation that is not absorbed by utilities and manufacturers, or offset by reducing production, will be paid for by increased cost prices for goods and services.

Such price burdens are disproportionately paid for by persons and industries that are undertaking new activity such as new household formations, persons buying their first home, their first car, as well as new factories and new facilities. The growth segments of our society that are expanding and thus purchasing more than the average in goods and services will pay more than the average for the increased costs of basic manufactured goods.

In summary, manufacturers are concerned with acid rain legislation mainly because of two factors. First, it would bring around a new round of electric rate increases which in turn will increase the cost of goods and services which are needed for economic recovery and, second, we are impressed with the testimony of International Paper. After we spend all this money, what will we have to show for it?

The NAM wishes to thank the members of this committee for this opportunity to present its views. We will supplement the prefiled written statement.

Senator STAFFORD. Thank you very much, Mr. Sherry.

Mr. Quarles.

STATEMENT OF JOHN QUARLES, ATTORNEY AT LAW, ON BEHALF OF THE NATIONAL ENVIRONMENTAL DEVELOPMENT ASSOCIATION, CLEAN AIR ACT PROJECT

Mr. QUARLES. Mr. Chairman, I appreciate the chance to present testimony before this committee on behalf of the National Environmental Development Association, Clean Air Act Project.

First, I would like to say that I, perhaps unlike many of the witnesses who have testified before these hearings, am not here to testify either in favor of, or in opposition to, an ambitious control program to deal with phenomenon of acid rain. Second, I would point out that I do not plan to repeat the testimony I gave last November which expressed the serious concerns of the major corporations and the building and construction trades labor unions that participate in NEDA/CAPP about the overall features of S. 768 other than acid rain.

What I will concentrate on in this testimony is more in the nature of a technical problem, you might even call it a drafting problem, but it is a problem that is serious and could have potentially severe consequences running through both the administration of the Clean Air Act control program and also severe consequences running through the economy.

Before I proceed to describe those consequences I would like to make a couple of preliminary comments. First, I think that these consequences are not ones that the committee necessarily intends to occur and, second, I think that they are not consequences that are necessarily required to achieve in order to fill the objectives of S. 768. In that sense, the problems that I am speaking to are perhaps correctable and they may even be reducible to matters of interpretation and purpose, but they are serious and I think they do require attention from the committee.

There are two principal components of the control strategy that is contained in S. 768 and most of the other acid rain bills. One of those, and the one that has achieved virtually all of the publicity, is the proposal to accomplish a reduction in present emissions. The other component is referred to as the emissions cap, and it is the emissions cap that I am going to concentrate on.

More specifically, the matter of concern to NEDA/CAPP arises from a single sentence in the bill which appears in section 183(c) of the Clean Air Act as it would be amended by the bill. That sentence states that "No major stationary source within—what is in effect a 31-State region—which began operation before January 1, 1981, shall increase its actual rate of emissions of sulfur oxide over that experienced by such source during the calendar year 1980 unless"—and now I paraphrase, unless the source has complied with the offsets requirements.

Senator STAFFORD. Would you tell us again what that particular section is, John?

Mr. QUARLES. Yes, sir. It is section 183, subsection (c), and that is the section reference to the act as of the amendment.

Now what that section would do and the cause of many of these problems is that it would make a fundamental change in the foundation for applying the regulatory framework. It would change it from a present system that is tied to allowable emissions to a revised system based on actual emissions. As you know, the present regulatory framework sets maximum allowable emissions for each source and it does that under the State implementation plans, and those maximum allowable emissions depend on various maximum assumptions as to the nature of operations, the hours per day, the days per week, the fuels used and other elements that go into it.

Actual operations obviously fluctuate, and so most of the time most sources actual emissions are well below their allowable emissions. That of course differs greatly from one source to another and from one period of time to another. What S. 768 does, it shifts to focus on the actual emissions that occurred during 1980, sets that as a base year, and says nobody can increase their rate of emissions above the base. At least that is the way I read the language and I think that is the intent.

That change and that proposal will have several severe consequences if it runs that course. One of the consequences relates to companies making full utilization of the productive capacity of their plant. If, for example, a company because of the oncoming recession that existed in 1980 or other factors was operating at only 16 percent of productive capacity, then there is a danger that this requirement would mean that that plant could not return to 100 percent operation.

Senator STAFFORD. John, would you summarize your testimony?

Mr. QUARLES. Yes.

In addition to that effect, there would be a restrictive effect on fuel selection. There would be an inability of companies that presently are allowed to use natural gas or oil or coal that may have used gas in the base year to switch. Many of those companies have interruptible gas supply contracts, and they could not carry out business operations if the gas were interrupted as provided in those contracts.

Finally, there would be established by section 183(c) in effect a 31-State nonattainment region with requirements to comply with offsets by all plants that might want to modify their facilities and expand them slightly or grow even slightly. That would cause particular problems for small facilities and especially in the South where there would be little ability to acquire offsets as a practical matter. We have had a lot of publicity about offset trading but it has not worked well.

In summary, Mr. Chairman, I don't think that these consequences are critical to the achievement of the acid rain control program but they are ones that would flow from the language of the emissions cap and I believe that that needs to be changed.

Senator STAFFORD. Thank you very much.

Thank you all.

I think this would be a good time for me to point out that you all are not being asked questions from any lack of interest or from the fact that you have not provoked questions on the part of this committee or this chairman because I wish I had the time to interrogate a number of the witnesses on statements that have been made. We will have to resort to written questions in order to get the information.

Thank you very much for joining us this morning, we appreciate it.

We will now invite the next four witnesses. Mr. Thomas White, Ms. Jacquelyn Tuxill, Mr. Kurt Anderson, and Mr. Neal Tostenson will come forward, please. Again we will go in the order in which I called your names. That means Mr. Thomas White, chairman, energy, environment and natural resources, National League of Cities will be first to be followed by Ms. Jacquelyn Tuxill, chairperson, New Hampshire Citizens Task Force on Acid Rain.

Mr. White, you are on.

STATEMENT OF THOMAS X. WHITE, CHAIRMAN, ENERGY, ENVIRONMENT AND NATURAL RESOURCES, NATIONAL LEAGUE OF CITIES

Mr. **White**. Thank you, Mr. Chairman.

I am Thomas White, a council member from the city of Greenbelt, Md., and Chairman of the National League of Cities' Energy, Environment and Natural Resources Committee. I am here today on behalf of the National League of Cities which represents 15,000 cities in every part of the nation to testify on the control strategy for air pollutant emissions responsible for acid rain.

Mr. Chairman, in keeping with your request to not repeat what was provided in a written statement, I will only highlight this morning the elements of NLC's national municipal policy on this issue which has been developed over the past year culminating in the adoption of that policy at our Congress of Cities in New Orleans in November 1983. I will provide to the recorder a copy of the excerpt of our national policy on acid deposition.

Senator **Stafford**. We will make that a part of the record.

Mr. **White**. The National League of Cities in our policy statement recommends that:

One, Congress should enact a program to reduce substantially sulfur dioxide and nitrous oxide emissions over a long-term period. By substantial reductions the policy development considerations and discussions considered 8 to 12 million tons of reductions of sulfur dioxide and nitrous oxide emissions over a 10- to 15-year period.

Second, the Federal Government should require any increases in sulfur and nitrogen oxide emissions be simultaneously offset by reductions from other existing sources of these pollutants.

Third, Congress should develop a specific mechanism to distribute the burden of compliance and costs to temper disproportionate rate increases and to mitigate the adverse impacts of the requirements on employment.

Fourth, compliance should be funded through revenues raised by imposing a fee on fossil fuel electricity generation within the 48 contiguous States exempting those facilities meeting new source performance standards.

Fifth, funds generated by user fees should be used to finance the capital costs of whatever technology base control methods are deemed appropriate by the affected utilities.

Sixth, Congress should direct EPA to increase the research and demonstration into new and less expensive technologies for reducing sulfur and nitrogen oxides and to develop economic uses for byproducts of the pollution control technologies.

Seventh, the Federal Government should recognize the offer of the Government of Canada for a bilateral 50-percent reduction in sulfur dioxide emissions and should conclude negotiations and adopt a treaty committing both countries to that goal.

I thank you, Mr. Chairman, for the opportunity to present this testimony and the league would be more than happy to respond to any questions that you or the committee direct to the league.

Senator **Stafford**. Thank you very much, Mr. White. You have concluded in a speed that gets the approval of anybody from the northern New England States.

Now Ms. Jacquelyn Tuxill, we would be glad to hear from you.

STATEMENT OF JACQUELYN TUXILL, CHAIRPERSON, NEW HAMPSHIRE CITIZENS' TASK FORCE ON ACID RAIN

Ms. **Tuxill**. Thank you, Mr. Chairman

My name is Jacquelyn Tuxill and I am representing the New Hampshire Citizens' Task Force on Acid Rain which consists of citizens and organizations in New Hampshire and New England.

Mr. Chairman, last week the EPA Administrator, Mr. Ruckelshaus, justified no action on acid rain by saying that acid rain control could be expensive and potentially divisive. I would like to say that I consider that wrong. Whenever we talk about the costs of acid rain control we must also consider the benefits of acid rain control and the costs of the acid rain damage that is occurring right now. I also take issue with his characterization of acid rain control as divisive.

I would like to say that the Reagan administration's position of more study and no action is, in fact, the most divisive course we could take at this point on acid rain. The people of this country have put divisiveness behind them and are actively seeking solutions to the acid rain problem, not denials and inaction.

The recent national citizens' conference, Acid Rain 1984, held in New Hampshire 1 month ago is a case in point. Nearly 700 people from 27 States all across the country, 150 of them representing the media, gathered together seeking remedies and action on acid rain. Coal miners from Kentucky sat down with sportsmen from New England. Representatives of the food products industry mingled with people concerned with public health effects of acid rain. Labor interests, educators, public officials, native Americans, legislators, scientists and environmentalists—all committed to solving the problem together—listened to scientists talk of the urgent need to control acid rain, and discussed with experts the control options available, the costs, the impact on jobs.

After 2 days there was not divisiveness and denials but unanimous agreement and a shared commitment to doing what is fair. A citizens platform calling for a 50-percent reduction in sulfur emissions nationwide by 1990 was hammered out in regional caucuses and was unanimously adopted, as was a United States-Canada citizens agreement calling on both countries to commit themselves to that goal, and I have included both documents with my testimony.

I am here today, Mr. Chairman, to say to you as strongly as I can that the people of this country will and do support an acid rain control program. Americans have a fundamental sense of fairness, they care about the integrity of their environment and natural resources, and they believe in the basic right to breathe clean air and drink clean water.

There are many other examples of citizen initiatives and support for acid rain control. You have heard about the Louis Harris polls. There have been polls taken in other States in North Carolina, New York, Minnesota that give the same results. There have been town meeting votes, citizens' hearings and many other examples of citizen initiatives.

To comment more specifically on legislative proposals, none of the bills currently before the committee meet what we in New Hampshire feel are the minimum requirements for effective acid rain control. We feel that the following three elements are essential:

No. 1, that SO_2 reduction must be 50 percent at a minimum. A 50-percent reduction should bring precipitation acidity to approximately pH 4.5. At a point below 4.5 fish cannot survive. But let us not lose sight of the fact, however, that even a 50-percent SO_2 reduction will still leave precipitation in the Northeast that will be acid. The 50-percent figure is not a magic threshold between damage and no damage. If a control program of less than 50 percent reduction is passed, the damage process may be slowed some but the end result in the long run will be the same. A 50-percent SO_2 reduction is the absolute non-negotiable minimum in our minds.

No. 2, the acid rain control program must be national in scope. Because of the regional inequities, the international implications, the potential for economic dislocations inherent in the fuel-switching debate and the growing evidence of acid rain damage in areas other than the Northeast, the solution must be national in scope and it must come now.

Many of these subissues are admittedly thorny but they can be solved. The Acid Rain Task Force of the National Governors' Association has tackled the issue and recommended acid rain control as have the Coalition of Northeastern Governors, the New England Governors Conference, the Western Governors Policy Office and the State and Territorial Air Pollution Program Administrators.

No. 3, any cost-sharing program incorporated into acid rain legislation must be tightly coupled with the 50-percent SO_2 reduction target. We, in New Hampshire, do not want to pay into a program that will not be effective in the long run in controlling the acid rain damage we're experiencing. In the interest of arriving at a solution to the problem, we in New Hampshire would consider a cost-sharing program that requires a 50-percent SO_2 reduction nationwide and takes into account past SO_2 cleanup efforts and current contributions to total sulfur emissions. The cost-sharing proposal in H.R. 4404, the New England Caucus bill in the House, is worth your consideration in this respect.

To summarize, the stage is set for action. The scientific evidence to justify immediate control of acid rain is there. The support of the citizens of this country for a fair and equitable acid rain control program is there and the commitment will continue to grow, I can assure you. But the leadership from the Reagan administration is not there.

This committee and Congress as a whole has a clear choice. You can backpedal down the administration's research-only road of denial and divisiveness or you can seize the baton handed to you by the people and the Governors of this country. I respectfully but most strongly urge you to act now to effectively control acid rain.

Thank you.

Senator **Stafford**. Thank you very much, Ms. Tuxill.

Now we will be happy to hear from Mr. Kurt Anderson, environmental affairs manager, New York Power Pool.

STATEMENT OF KURT ANDERSON, ENVIRONMENTAL AFFAIRS MANAGER, NEW YORK POWER POOL

Mr. **Anderson**. I am pleased to be here this morning.

I represent the electric industry in the State of New York which provides about 99 percent of the electric power.

I guess the essence of my testimony today is that the committee does not really possess the types of studies on the environmental effectiveness that additional reductions of sulfur emissions from powerplants will have. Before enacting a proposal that will result in increased electricity costs by up to $700 million annually in New York State, I think your committee should ascertain the nature and extent of the alleged environmental damage and come to grips with the most reasonable, effective and economical method that can be legislated to decrease the impact, if the results show they are significant. Part 182 includes that approach, Senator, and we support this legislation. However, the rest of part E we don't feel will result in demonstrable environmental benefits; and while we are finding that out, hundreds of millions of dollars will be added to the cost of a basic energy source—electricity.

We feel that increasing the cost of electricity has two major questions that need to be answered and be seriously studied: Will the environment be improved? What is the cost to the public? We have estimates on the costs and of course the question of environmental benefit is much in doubt yet.

The scientific community that is studying the environmental impacts and causative mechanisms of acid precipitation has recently developed a consensus—I might add that this is very recent—which calls into question many of the assumptions stated in section 180 of the bill. We believe the causes and effects of acid precipitation are not understood sufficiently to make informed policy judgments at this time. Hence, we support section 182 and not the other provisions of part E.

The broad reviews of the present scientific understanding of the causes and effects done by the National Academy, EPA, and others cite the lack of information to make firm conclusions on the effectiveness of control measures. Scientists actively engaged in acid precipitation research are not able to support the wide-scale "death and destruction" allegations of the more extreme proponents. Neither can they support the theory that acidification is accelerating; there is time for research before legislative action.

Scientific investigation indicates that the impacts of acidity in rainfall on our croplands is minimal, the effects on forests has been described by Mr. Gonick earlier, and that recent attempts to justify acid rain legislation on public health grounds has been solely on the basis of speculation, not on scientific evidence. The major impacts on materials probably occur from freeze-thaw cycles and chemical attack from other sources such as road salting, corrosive sea spray and the effects of low-level local air pollutant sources. However, those sources have been diminished greatly under the present Clean Air Act.

Another issue is the long-range versus short-range source impact issue. In New York of course, as you have heard, sulfur emissions have decreased by 50 percent in the last decade and a half. Now if local sources dominate, that 50-percent reduction of the sources in New York State should have had a demonstrable effect. Local sources impacts especially on water quality, should have been noticible yet the studies done by the U.S. Geological Survey that measured the pH of various watersheds in New York State since the mid-1960's detected no significant change over that same time period.

A decade of high quality measurement of rainfall shows that acidity is neither increasing nor decreasing. No trends in precipitation or in water quality are seen even though the Clean Air Act has caused a significant reduction in sulfur emissions.

The Adirondacks have approximately 2,750 lakes and ponds. The media has described widespread destruction while in fact only about one-third of those 2,750 lakes have ever been sampled and of those that have been sampled represent about 5 percent of the lake acres of the Adirondacks that have acidity levels classified as critical. Those that are classified critical—that is, having a pH of less than five—are commonly called dead by the media. However, a number of those lakes do have fish in them so they are not "dead". The reported 212 "dead" lakes I don't think can be substantiated by actual record of the chemical quality of those lakes and the fisheries in them.

Recent findings also show that other chemical factors may be limiting fish populations in the Adirondacks and elsewhere. I bring it to your attention because much of the debate revolves about the alleged impacts of acid rain and I use the term "alleged" because we have not yet defined either the nature or extent of aquatic impacts.

It seems reasonable that a better understanding of the magnitude of the problem is necessary before effective action can be taken. Understanding and defining the problem before proceeding with a solution is a basic precept of science, technology and public policymaking.

We understand from our detailed but limited studies in the Adirondacks that the chemistry of the two score lakes that have been studied show wide variations due to the minerology of the soils, the hydraulic characteristics of the watershed and the types of forest cover. Scientists have shown that adjacent lakes separated only by a hill can have completely different characteristics and differences in acidity range by a factor of 50 over a distance of 1 mile. This suggests that indigenous factors can be far more significant than acid deposition.

The high cost of electricity is a concern to us.

Senator STAFFORD. Can you summarize at this point?

Mr. **Anderson**. Yes.

Mr. Chairman, there is considerable uncertainty whether the proposal to drastically decrease sulfur emissions from powerplants will have any demonstrable beneficial environmental result. On the other hand, the huge cost and economic impact of implementing such emission reductions is obvious. The member systems of the power pool urge that enactment of the type of legislation being considered by your committee should await a better scientific understanding. We urge Congress to support additional scientific research to ascertain the nature and extent of environmental damage and better define the most reasonable, effective and economical ways of decreasing the environmental impacts, if and where they are found to be significant.

Thank you.

Senator **Stafford**. Thank you very much.

Now we will be glad to hear from Mr. Neal Tostenson, President, Ohio Mining & Reclamation Association.

STATEMENT OF NEAL S. TOSTENSON, PRESIDENT, OHIO MINING & RECLAMATION ASSOCIATION

Mr. **Tostenson**. Thank you, Mr. Chairman.

I am president of the Ohio Mining & Reclamation Association, a coal trade association in southeastern Ohio. As a farmer and landowner and resident of that part of the State of Ohio I stand here today in support of President Reagan's position and we in Ohio feel it took real courage with the press the way it has been on this issue to stand up and take the position he has. We feel it is a responsible position.

I come here to tell you that while coal production nationally has gone up over 200 million tons in the last decade, in Ohio we produced 55 million tons in 1970, this past year we are about 31.7 million tons. We continually have gone downhill in Ohio at a cost to employment. We have got over 9,000 unemployed coal miners there today and if this legislation were to pass, I would estimate that 60 percent of our remaining production would be lost.

In 1978 as a Federal SO_2 plan was being adopted in Ohio the regional EPA Administrator said there would be no loss of jobs but the facts have proved out what we in the coal industry said then and I think the facts would be equally true today. Last year alone we lost 5 million tons of production. That is $140 million in the Ohio economy.

Earlier today you have heard from the president of Kaiser Aluminum. The electricity for that aluminum plant that he talked about comes from Ohio and is produced by Ohio coal. We would lose that market for that total plant right there if we had the implementation.

I am not going to go into the scientific debate on this issue but how I see it affects Ohio. We have had continuing forays into Ohio by the Canadians and I think, No. 1, when you look at what the electricity industry is doing in Canada with the construction of three new powerplants in Ontario by the Federal Government up there with an excess power capacity, it is very obvious why they want a 50-percent reduction in the United States. They want to capture power being generated in Ohio which unfortunately is the largest coal-consuming State in the country.

But Ohio has done things. In recent years Ohio has reduced SO_2 emissions over 20 percent. When you consider that, why haven't we had a reduction in acid deposition if we are putting out less in the heartland of Ohio? It does not make logical sense.

Two, Ohio has spent more on air and water pollution controls in the last decade than any other State in the Union.

Three, Ohio Edison, the electric utility in Ohio, spent $500 million at one powerplant on particulate cleanup which is equal to the whole sum the Canadian Government wants to spend. Ohio coal operators in the last 5 years have either built new ones or updated over 25 coal preparation plants to wash coal. Ohio has not had a sulfur dioxide emission violation in the 1980's. In addition to this our State government under Governor Celeste has recently introduced legislation to create a Coal Development Agency to promote new technologies.

The State of Ohio also constructed a fluidized big boiler at one of their State hospitals in an attempt to bring about new technologies. So I feel that we are doing something in Ohio but if we have mandated substantially SO_2 emission we are going to decimate the Ohio coalfields. We have already been severely crippled because of SO_2 emission standards.

And on top of this, in closing I would like to say that there has been a lot of rhetoric on this issue. The representative from the League of Women Voters talks about damage to corn crops yet my hometown newspaper in southeast Ohio says tests show crops thrive by acid. We didn't do this study, it was done out at the University of Illinois. I wonder where all of the truth is in this whole issue. Our biggest concern is not for the grandparents and the kids being able to go fishing, it is for the parents to have a job and work and raise those children with a decent environment.

Thank you. It is a very emotional issue in Ohio and we appreciate your consideration, Mr. Chairman.

Senator STAFFORD. Well, thank you very much, Mr. Tostenson. When you mentioned rhetoric it occurred to me that all of the Democratic candidates for the Presidency are in favor of acid rain deposition. I therefore assume that you and your colleague here this morning, Mr. Anderson, would feel the Democratic candidates are in error in their position.

Mr. TOSTENSON. I happen to be registered on the Democratic side in southeastern Ohio but I am still going to stand up for President Reagan.

Mr. ANDERSON. Mr. Chairman, if I may for a moment. Mr. Quarles brought up an issue—and this is a real issue, by the way—and I would say that your committee needs to deal with that.

Senator STAFFORD. He is not the first one that has mentioned it and I have made a particular note to look into it.

Thank you all very much. We appreciate what you have done to help us in our deliberations.

The last group this morning will be Mr. James Scahill, executive vice president, Pennsylvania Coal Mining Association; Mr. Ralph Abele, executive director, Pennsylvania Fish Commission; Mr. Evern Wall, president and chief executive officer, El Paso Electric

Co. speaking on behalf of West Associates, and Mr. Harry L. Storey, director of industry and legislative affairs, Anaconda Minerals Co. speaking on behalf of Western Regional Council.

Mr. Scahill will be first followed by Mr. Abele.

Mr. Scahill, the floor is yours.

STATEMENT OF JAMES SCAHILL, EXECUTIVE VICE PRESIDENT, PENNSYLVANIA COAL MINING ASSOCIATION, ACCOMPANIED BY WILSON FISHER, TECHNICAL COMMITTEE CHAIRMAN

Mr. **Scahill**. Thank you, Senator.

I am James Scahill, executive vice president of the Pennsylvania Coal Mining Association.

I would at some point in time later ask our technical chairman, Wilson Fisher, to present a small part of this testimony.

Senator **Stafford**. It will have to be within the 5-minute rule.

Mr. **Scahill**. Yes, sir, it will be.

Pennsylvania is blessed with coal. We have 30 billion tons of coal that we can get mined that is recoverable. I think a significant fact is we have mined and burned 23 billion tons of coal in our 260-year mining history. Surely the acid rain issue should have surfaced long before it did in the early 60 should coal be the culprit.

The Clean Air Act of 1970, we have to look at that history of what it did to us then to find out what direction we should go in. The Clean Air Act devastated the mining industry in Pennsylvania, its effects are still being felt. Due to that act Pennsylvania now imports 15 million tons of coal annually from other States—something we never did—to comply with the provisions of the act. That tonnage displacement has resulted in the loss of over 4,000 permanent mining jobs and 10,000 to 20,000 supporting jobs. It has also resulted in very great socioeconomic upheavals in our mining towns in Pennsylvania.

SO_2 emission reduction bills currently being studied by Congress would have the following result: In Pennsylvania we would lose 12,000 jobs, in Ohio 21,000 jobs, in West Virginia 24,000 jobs, based on the Congressional Research Service in its just recently published Penn State study. To a region that can already trace part of its economic problem to paying a disproportionate share of the cost, any further reduction in SO_2 emissions is unthinkable.

Very little has been mentioned about the indirect, but costly, economic burden that has also been placed on the electrical consumer. The often quoted Harris poll asked the loaded question: "Do you want clean air?" paying scant attention to the exact amount the American public is willing to pay for current or future environmental control costs. I might add, Senator, surprisingly only 78 percent of the people surveyed wanted clean air. I would imagine the other 22 percent were out of work and would not want clean air.

In the only study to date on the matter of cost consumers would be willing to pay to support acid precipitation controls, that is further controls—and this is the only study that has asked the cost question—Missouri voters responded that 30 percent would be willing to pay no extra cost, 32 percent would be willing to pay no more than $1 to $5 and only 2 percent are willing to pay the estimated $25 per month increase.

In other words, the American public has been duped into believing that pollution control costs are minimal by the environmentalists. The National Wildlife Federation is presently telling people in Pennsylvania that further SO_2 emission reductions will only cost them 67 cents per their electric bill per month, an argument the environmentalists used in the sixties in urging passage of the original Clean Air Act.

Let's look at the actual figures. We can look back. Compared with utilities' present environmental control costs, and using the sixties' environmentalists' figure of 50 cents per electric bill, if we compare that to what the actual cost of the utility is for environmental control costs, it would mean that everyone's electric bill would be $4 to $6 because that 50 cents would constitute 15 percent of the actual cost on the average for environmental control cost today. I know of no one that has a $4 or $6 electric bill. Right now, today, people are paying anywhere from $4 to $20 plus per electric bill per month for environmental control costs. When compared with the above Missouri survey, 62 percent of the people in Missouri have already reached a limit of what they are willing to pay for controls.

More frightening, the Clean Air Act was designed to replace older plants with new source plants. According to some utilities, environmental control costs constitute 33 percent of a consumer's monthly electric bill for new source plants. The cost of any further reduction of SO_2 emissions has been estimated to cost an additional 50 percent of average monthly bills. The American public should be shown what they pay now and what they are going to pay in actual dollars for controls.

At this time I would like to call Wilson Fisher up for the technical part of this.

Senator **Stafford**. You have about 1 minute.

Mr. **Scahill**. All right.

Mr. **Wilson**. Mr. Chairman, I think I will just take a moment to point out an EPA chart which we reproduced from some of their information. This is without the Clean Air Act. This is what we are into today, sir, a constant reduction of SO_2 emissions over time that is reflecting itself, as the gentleman from Ohio said, in reductions that have been observed or improvements or stabilization in the quality of streams by the U.S. Geological Survey.

The actual bills before Congress at this point in time are going to provide us with this reduction, sir, this incremental improvement, whereas we are looking at a crossover in time with new technologies of meeting that same objective shortly after the year 2005 without new technological innovations or by the year 2015 as per the trend of the Clean Air Act and its compelling reductions.

I mention the USGS study which was just published, and the gentleman from Ohio mentioned it. I will hold it up, sir. The title is: "An Evaluation of Trends on the Acidity of Precipitation and Related Acidification of Surface Water in North America." It is very significant as far as the findings in the Northeast are concerned. They are extensive in their comprehensive water quality measuring stations which are continuously monitoring the characteristics of the water quality across the Nation which indicate that the water quality characteristics in the Northeast have stabilized since the 1960's and continue to do so, a reflection of the reductions as imposed by the Clean Air Act.

In conclusion, sir, this is a tabulation that relates to the cost effectiveness of some of the control, sir, and I might point out that this is relating to expected precipitation acidity. This was an evaluation done by the Energy Laboratory of the Massachusetts Institute of Technology and assuming the worst case circumstance, rain pH of 4.05, the column No. 7, a 45-percent reduction in SO_2, sir, will give us an improvement in pH rainfall of 0.15 to 4.2. We submit to you that that is hardly cost effective and certainly basis for due consideration in your deliberations.

Senator **STAFFORD**. All right. Thank you very much.

Mr. Abele, we will hear from you.

STATEMENT OF RALPH ABELE, EXECUTIVE DIRECTOR, PENNSYLVANIA FISH COMMISSION, AND CHAIRMAN, ACID PRECIPITATION COMMITTEE, INTERNATIONAL ASSOCIATION OF FISH & WILDLIFE AGENCIES

Mr. **ABELE**. I am Ralph Abele, executive director, Pennsylvania Fish Commission.

Thank you for the opportunity to express my concerns about the trend that has manifested itself on the impact of acid deposition to the environment of Pennsylvania, particularly on our fisheries. As executive director of the Pennsylvania Fish Commission, an independent agency not under the Governor's jurisdiction, my position does not reflect that of the current State administration in Harrisburg.

I represent also the International Association of Fish & Wildlife Agencies.

Pennsylvania is in the "eye" of the acid deposition storms. Downwind of the Ohio Valley, the Nation's greatest industrial complex, which indeed includes our own steel capital of Pittsburgh, we receive, not surprisingly, the most acidic precipitation in the world over so large an area. In fact, our State has been identified by some as keystone to the entire clean air issue. After Ohio, Pennsylvania is the greatest perpetrator of SO_2 in the Nation and with a stabilized pH of 4.0 to 4.1, we are fast becoming its primary victim as well.

You have, I am certain, heard witnesses from both sides testify to the impacts on agriculture, forest dieback, buildings, gravestones, concrete and steel bridges, visibility costs which the EPA study indicates will be reduced by $4 billion annually, and human health. Therefore, my comments focus upon a succinct summation of what we have observed occurring to the fisheries in the Commonwealth. The brochure which I have made available dramatically illustrates the current breadth of these damages.

Senator, there is a map enclosed with my testimony and depicted in red are those streams that now have an alkalinity of less than 10 parts per million. We know that that acidity was more than double that 15 years ago. None of these are affected by acid rain and there is no other cause that we can determine. We even eliminated those where there is a natural acidity caused by bogs. If we make a projection at the current rate, those 5,100 miles of heavy water streams with no buffering effect would be gone by the end of the century and the only way to reverse it would be to recreate and put the limestone on the top.

Of 41 such streams randomly selected which naturally offer the poorest buffering capacity, pH of only 3 of these increased over a span of 15 years while 19 of them decreased. More significantly, the alkalinity, a less volatile, precursory parameter, decreased on 37 streams and showed an inconclusive trend on the other 4. Most alarming, the average alkalinity of these streams decreased from 20 parts per million to 9 parts per million during this brief time period.

By 1981, 5,100 miles of stocked and unstocked trout streams had an alkalinity of less than 10 parts per million. Water with a buffering capacity of 10 parts per million or less was classified as vulnerable to fisheries loss by the Stockholm Conference in 1982. Few of these waters were vulnerable in the early 1960's from our own records. We are desolated by the fact that these vulnerable streams represent our State's very highest quality trout fishery. This quality, however, is being gradually eroded.

As the unit fishing pressure on our resources, most particularly our trout waters, is the heaviest in the Nation, according to the Sport Fishing Institute, we can ill afford to lose any of these fisheries. However, if the trend of alkalinity loss which we have experienced for the past 16 years continues, there will be 5,000 miles of former basically high quality trout streams which will be either fishless or approaching that condition by the end of this century.

Loss of these fisheries equates to a loss of economic value in excess of $100 million annually or at a 10-percent discount rate, a capitalized value of over $1 billion. This is Pennsylvania's indirect answer to David Stockman's question, "What are 170 lakes in the Adirondacks worth?"

It is impossible for me to accept the arguments of industry. Industry says the rain has always been acidic—that's true. Volcanoes are responsible—partially true. The soils are responsible—partially true. The maturing forests are responsible—ridiculous! These people make good candidates for membership in the Society of the Flat Earth, all the while proclaiming insufficient scientific evidence to the contrary.

The loss of alkalinity in our soil, bedrock, and water is a cumulative process. Alkalinity cannot be restored. The Alka-Seltzer is running out. Holding the line with rainfall pH means only that the deterioration will continue at the same current rate.

I have no problem with additional research conducted along with, not as a substitute for, the action we so desperately need. I'm afraid that a few more years will give us the well-documented disaster this administration insists upon.

Cutting SO_2 emissions within a decade is financially feasible. Halfway measures, such as a 5-million-ton reduction, or more research, simply avoid the urgency as I see it. As great as is my concern for our recreational fisheries, a greater concern is the role of fish as the miner's canary. We have developed acid-resistant trout and that is tantamount to developing a gas-resistant canary for use in mines.

Mr. Chairman, Senate bill 769 represents the type of response that is required to finally turn this dreadful scourge around. Based upon the trend which is evident in Pennsylvania as a result of the current deposition rate, our losses will become intolerable in another 10 years. The time schedule for implementation of Senate bill 769 is too lenient to protect many, if not most, of our currently vulnerable streams.

Thank you, Mr. Chairman, for your consideration.

Senator **Stafford**. Thank you very much, sir. We appreciate your testimony.

Now we will be very glad to hear from Mr. Evern Wall, who is president and chief executive officer of the El Paso Electric Co., El Paso, Tex.

STATEMENT OF EVERN WALL, PRESIDENT AND CHIEF EXECUTIVE OFFICER, EL PASO ELECTRIC CO., ON BEHALF OF WEST ASSOCIATES

Mr. **Wall**. Thank you, Mr. Chairman. I am delighted to be here.

I am Evern Wall, president of WEST Associates and president and chief executive officer of the El Paso Electric Co., which is an investor-owned utility in Texas.

WEST is a research and information group of 21 publicly owned and investor-owned electric utilities serving about 19 million customers in 8 Western and Southwestern States. WEST believes that there are important regional differences. The western customer is already paying a stiff price for clean air. We think that these things should be considered in any acid rain discussion.

I would like to take just a few moments to highlight five of the differences and then offer a number of principles which WEST Associates believe should guide any acid rain legislation.

First, the 17 States, WEST, have far fewer total emission sources. The sources are much less than those in the East. The western SO_2 emission represents only 7 percent of the sulfur dioxide emission from all U.S. coal-fired generation. The West has less than one-fifth of the coal-fired electric power producing generation stations in this country versus 81 percent in the East. Additionally, the West coal is far cleaner with an average of one-third the sulfur content of eastern coal; specifically about 0.64 sulfur average in the West versus a conservative 2 percent in the East.

In addition to that, the Western States have very strong regulations on emission standards, much stronger than the national requirements. Despite the low sulfur coal, the West already cleans up more than four times the percentage of coal-fired generation than does the East, specifically 31 percent of the coal generation in the West is struck versus only 7 percent in the East.

Electric utility customers in the West are permitted to pay billions of dollars to reduce powerplant emission without help from other regions. Up to 30 percent of electric bills in some Western States is directly attributable to powerplant pollution controls. To give you an idea of the WEST commitment to clean up its emissions, customers of the 21 WEST member companies have thus far been committed to pay on an investment of approximately $2.4 billion for emission controls on our powerplants alone.

I am submitting for the record two WEST Association maps which use EPA data to illustrate the striking difference in sulfur dioxide emission density between the East and the West.[1] The first map depicts 1980 SO_2 emissions and shows that peak emission density in the East range from 6 to 20 times those densities in the West. The second map projects 1995 SO_2 densities after a reduction of 10 million tons in 31 Eastern States.

The maps show that peak emissions in the East remained dramatically higher than those in the West by as much as four times in some areas. Despite these regional differences, various acid rain legislative proposals in the Senate and the House seek to have Western utility customers pay additional amounts for pollution control equipment in other areas, some bills propose a tax of 1 mill per kilowatt-hour on most of the electricity generated in the East and the West. This could amount to a transfer of nearly $700 million annually from the West, a particularly unfair and discriminatory proposal considering that all of the top 60 SO_2 powerplants which have been identified are owned or are east of the Mississippi River.

Given this situation, WEST Associates strongly object to cost-sharing proposals which will unfairly burden western consumers who now pay a premium for clean air. We in the West have already paid. We are paying, we will continue to pay our fair share for clean air.

Now I recognize this committee is considering provisions in S. 768. That bill does not include the cost-sharing mechanism or a number of the other objectionable provisions which are contained in H.R. 3400. Regarding additional West acid rain principles that should guide the legislation, we believe that more research and demonstration is required. We ought to first spend millions on research before risking the expenditure of billions of dollars on a hopefully controlled program.

We believe that if the control efforts are prescribed, they should be based on research findings and should be applied where demonstrated, significant problems exist. We believe that least cost methods for emission reductions such as fuel switching and coal washing should be carefully considered. Mandating particular control technology such as scrubbers which are the highest cost option does not represent sound public policy. Finally, we believe unique original differences must be considered.

Thank you for this opportunity for allowing us to share the western view.

Senator STAFFORD. Thank you very much, Mr. Wall.

I will say that 2 days ago two of the Western Governors spoke in the same general vein and quite eloquently pointed out what has been done in their States in opposing very stringent SO_2 emission controls on powerplant construction in that area.

I wonder, would it be possible for the WEST Associates to supply this committee with a list of the plants that are owned by the members and in each case the cost attributable to air pollution control. If you could do that, Senator Domenici who is from your part of the country has asked for that information and it would be helpful for us.

---

[1] The maps referred to have been retained in committee files.

Mr. WALL. We will be delighted to do that, Senator.

Senator STAFFORD. Now we will hear from Mr. Harry L. Storey who is director of industry and legislative affairs, Anaconda Minerals Co., Denver, Colo., speaking on behalf of Western Regional Council.

STATEMENT OF HARRY L. STOREY, DIRECTOR OF INDUSTRY AND LEGISLATIVE AFFAIRS, ANACONDA MINERALS CO., ON BEHALF OF THE WESTERN REGIONAL COUNCIL

Mr. STOREY. Thank you very much, Mr. Chairman.

I am Harry L. Storey, director for industry and legislative affairs, the Anaconda Minerals Co. in Denver, Colo. I appear before you today as chairman of the Western Regional Council's Clean Air Committee.

The Western Regional Council is a coalition of some 46 companies active in the 8 Rocky Mountain States. Our membership includes businesses engaged in financial, energy, mining, transportation, construction and engineering, utilities, and manufacturing.

Mr. Chairman, of the acid rain control proposals now before the Congress, we prefer the approaches taken in S. 768. We urge the committee to adhere to the straightforward acid rain research and reduction concepts of that bill.

A number of factors contribute to the difference between the eastern and the western regional situation: First, the drier climate of the West results in less acid formation in the atmosphere. Second, much of the West has a typically alkaline soil which provides buffering capacity with respect to acidic reactions. Third, there are fewer major emission sources in the West and they are widely distributed geographically. Fourth, and most important, Western coal-fired stationary sources use low sulfur fuels and are already subject to the Nation's most stringent emission limitations. For example, the State of Utah requires new utility sources to not only use low sulfur coal but have struck a limit of 90 percent.

The State of Wyoming has set a standard that is probably the lowest in the Nation of 0.2 pound of SO_2 per million Btu. Mr. Chairman, of the 17.3 million tons of SO_2 emitted annually by coal-fired power plants in the United States., only 455,000 tons are emitted in the eight Rocky Mountain States or 3 percent of the total. As stationary emission sources in the West continue to be reduced, I think our potential of acid deposition or acid rain damage decreases.

Mr. Chairman, the 17 Western States emit only 7 percent of the Nation's utility SO_2, 1.2 million tons per year, while generating 19 percent of the U.S. coal-fired electricity. If the entire Nation were proportionately meeting these emission levels, the total utility SO_2 emissions in the United States today would be approximately 6 million tons instead of the 17.3 million tons.

Western consumers are currently paying approximately 25 percent, and the actual number is 25 to 27 percent, of our electric bill for the installation and operation of that pollution control. Montana Power's coalstrip units 3 and 4 will emit .07 pound SO_2 per million Btu. Of the $1.4 billion cost, $500 million or 35 percent of the total cost, is for pollution control. Capital costs at the new intermountain power project in Utah will include approximately $310 million for pollution control.

It should be understandable then that we in the West oppose the spreading of the cost of emission reductions to control acid rain. Not only do we believe that spreading of the costs is unfair to those who are already paying for emission reductions, but we also believe that a spreading of the cost removes incentives for sources to seek, which we feel very important, the most cost-effective emission control method.

S. 768 does not spread the cost. We agree and support that premise. Some legislative proposals would have the entire Nation subsidize the costs of SO_2 reductions. We should not consider in environmental legislation the idea that the last one to comply, the last one to clean up, should be compensated or rewarded for their delay. We believe that it would be a bad precedent and can see no equity in proposals to spread the cost of emission reductions beyond the individual sources.

Some legislative proposals have also included provisions mandating the use of control technology. Again, we agree with the source flexibility provided in S. 768 for emission reductions. Mandatory scrubbing has nothing to do with the environmental problem of acid rain but instead with preserving Midwestern high sulfur coal mining jobs. Coupling forced scrubbing to preserve jobs with a national cost sharing program for purposes of political coalitions obscures the environmental goal of acid rain legislation. It makes the Nation's cost unnecessarily high, particularly in this period of economic recovery and a high Federal deficit.

Proponents of protecting high sulfur coal mining jobs claim there would be severe regional dislocation without mandated scrubbing; We believe that the miner displacement issue is an overemphasized consideration in the acid rain debate. Studies indicate that if utilities were to select nonscrubbing options for emission reductions, there would be some shifts in high sulfur versus low sulfur coal mining employment and location. But there will be overall increases in coal mine employment of approximately 120,000 jobs over the next 15 years.

Senator STAFFORD. Would you summarize at this point, please.

Mr. STOREY. Certainly.

Senator, there are other costs associated with a mandatory scrubbing scenario, environmental costs. We estimate, for example, that about 3.5 tons of sludge will have to be disposed of for each 1 ton of SO_2 recovery.

The WRC encourages you to retain the approach to acid rain legislation now embodied in S. 768. We have found virtual agreement in the West among our Governors and business organizations on these recommendations. We believe that they make economic sense and are environmentally sound. We recommend that you move ahead with research so we know the scientific basis upon which to assess and make long term policy decisions. Begin reductions in the meantime, based upon what we do know and increase mitigation measures as initial reductions are being achieved. Permit flexibility in achieving SO_2 reductions and promote the use of the most cost-effective methods. Avoid spreading the cost as it will drive the total cost of reductions up, exacerbate economic effects, penalize those who have already cleaned up and probably delay the realization of a first phase of reductions by encouraging installation of control terminology.

Senator, I want to thank you for this opportunity to present our views before your committee.

Senator **STAFFORD**. We thank you, sir, and all of you who are in this group in front of our committee.

I think we can all, as we bring these hearings to a close, agree that this committee and this chairman in the light of divergent views that we have listened to over the last four days of hearings have got ourselves a real difficult job but from the diverse views we hope to find solutions that the committee can support and the Senate can adopt and the Congress and the President can agree.

Thank you all very much.

The committee stands adjourned.

[Whereupon, at 12:10 p.m. the committee adjourned to reconvene at the call of the Chair.]

[Statements submitted for the record follow:]

STATEMENT OF A. STEPHENS HUTCHCRAFT, JR.
PRESIDENT OF KAISER ALUMINUM & CHEMICAL CORPORATION
REPRESENTING
THE ALUMINUM ASSOCIATION
BEFORE THE
SENATE ENVIRONMENT & PUBLIC WORKS COMMITTEE
FEBRUARY 10, 1984

Thank you, Mr. Chairman. My name is Steve Hutchcraft. I am president of Kaiser Aluminum & Chemical Corp. and I am pleased to represent the Aluminum Association, Inc. at these important hearings.

The Aluminum Association represents the U.S. aluminum industry. Its membership includes 10 of the 11 domestic producers of primary ingot, many producers of semi-fabricated aluminum products, foundries, secondary smelters and producers of aluminum electrical conductors. Association member companies account for virtually all of the domestic primary aluminum production and 85 percent of the shipments of U.S. semi-fabricated products.

My remarks will focus on the very damaging impact that various pending acid deposition proposals would have on the industry and the company I represent. Briefly stated, the proposals pending before this Committee would significantly increase electricity costs and drastically affect the international competitiveness and future development of the U.S. aluminum industry. This regrettable consequence would translate into reduced economic growth, lost jobs, lost tax revenues, trade imbalances and a weakening of our country's industrial base.

As a major industrial user of electricity, our industry adds a voice that has not been heard in the debate on acid rain.

The U.S. aluminum industry is a major basic industry providing employment for almost a half million people in more than 700 plant locations in virtually every state. Wages paid to our workers are among the highest for any industry. Primary production...the making of aluminum...is carried on in the Pacific Northwest, along the St.Lawrence Seaway, in the TVA service area, in the Ohio River Basin, in the Gulf Coast region and along the Eastern Seaboard.

The U.S. is by far the world's largest user of aluminum. Products of the industry are essential in every facet of American life: from containers and packaging to construction, transportation, electrical transmission, consumer durables and machinery and equipment. Ten percent of the products of the domestic aluminum industry are exported. For 1983, a difficult year, total sales are estimated to be in excess of $20 billion.

Aluminum is irreplaceable in many critical defense applications from aircraft and missiles to explosives. Advanced alloys, rapid solidification, powder metallurgy and other technologies all lead to higher strength-to-weight ratio materials for better military performance.

The U.S. aluminum industry is preeminent in the world. We are today, however, faced with significant challenges from international competitors. These challenges are directly affected by the direction of U.S. Government policies. First and foremost are policies concerned with energy costs.

Aluminum smelters produce aluminum metal from alumina ore by using an electrolytic process which is both electricity dependent and electricity intensive. The production of aluminum is highly energy cost sensitive. Electric power rates and how they are determined have a direct impact on our ability to compete in international trade.

Proposed legislative approaches to the acid deposition issue will add tremendous costs to electrical generation. As a large purchaser of electricity the aluminum industry is a major stakeholder in the debate.

Electricity costs represent about one-third of the cost of producing aluminum. On average, it takes 7.5 kilowatt hours of electricity to make a pound of aluminum. Based on 1982 data, the average U.S. cost of electricity for aluminum production was estimated to be 2.4 cents or 24 mills per kilowatt hour, and in the last year this cost climbed even higher. Our Free World competitors, in contrast, pay an average of 1.7 cents or 17 mills per kilowatt hour. Some foreign smelters including Canadian smelters pay as little as 3 mills. Foreign smelters thus already hold a large competitive advantage in terms of this major component of the cost of producing aluminum.

Power cost policies in other countries favor their domestic aluminum industries. In the past 25 years government ownership of, or equity participation in, primary aluminum production has grown to more than 40 percent of the world's total capacity. Government-owned plants tend to stay in operation regardless of demand because of their goals of providing employment and generating foreign exchange. Aluminum smelters have been built in Africa, Asia, the Middle East, Oceania and South America near raw material sources and available low-cost power. This has caused the U.S. share of world primary aluminum production to shrink from about 44 percent to 30 percent in the thirty-year period between 1950-1980.

Power costs have a direct impact on aluminum capacity utilization worldwide and, therefore, on jobs. With a 7 mill disadvantage compared to Free World competitors, capacity utilization in the United States during the recent recession was 20 percent less than most other Free World producing nations. During this recession all but the industry's lowest cost facilities were closed or curtailed.

An analysis conducted by the Aluminum Association shows that proposed controls to reduce SO_2-emissions by 8 million tons could increase the cost of electricity to some aluminum plants in the 31-state region by more than 10 mills per kilowatt hour. This means an additional 7½ cents per pound to the cost of producing primary aluminum.

Approximately 60 percent of the aluminum industry's capacity in the United States is located in the 31-state region. Ninety percent of that capacity depends on coal-fired electricity and will be directly affected by increased costs resulting from proposed SO_2 reductions.

While aluminum production is energy intensive, it converts electricity into a product that...through its lightweight, strength, durability, corrosion resistance and recyclability...contributes greatly to our national well-being. The aluminum industry takes pride in the fact that since 1972 we have reduced the amount of energy needed to make aluminum by 23.2 percent. These savings have been as important to the nation as they have been to our industry's economic health.

Further, we in the aluminum industry are proud of our environmental record. The industry has been innovative in the development of technology for emission control. The best available technology now required by the EPA New Source Performance Standards was developed by the industry before it was mandated by the Clean Air Act. This technology is still accepted as best available technology for meeting the standards for prevention of significant deterioration of air quality. All of the industry has been retrofitted to conform with EPA and state standards for emission control for existing plants at a cost of hundreds of millions of dollars. Similar innovations are currently in place or under development for water and solid waste management. In addition, the aluminum industry has played a major role in litter cleanup. Largely through the coordinating efforts of the industry, over half of the aluminum cans produced in the U.S. are returned to the industry for recycling...a 95% energy savings. These actions demonstrate that we are sensitive to the need for environmental protection, and are in fact leaders in this effort. I am also personally committed to environmental protection. I am a lifelong member of the Audubon Society and as a boy I spent my summers canoeing in the Adirondacks.

We find, however, that in the debate on acid deposition, energy, economic and environmental concerns have become intertwined. We urge this Committee to seek an answer that will not penalize major industrial users of electricity such as aluminum....and will not penalize any one section of the country either environmentally or economically.

Let me focus briefly on how acid deposition controls would damage my own company. Kaiser Aluminum owns and operates an integrated aluminum smelter and rolling mill facility in Ravenswood, West Virginia. The cost of electric power supplied to Ravenswood is approximately in line with the U.S. aluminum smelter average of 24 mills per kilowatt hour.

Based on the best information we can obtain, we estimate that an increase of 25 percent or more in electricity prices to Ravenswood would result from passage of pending acid rain legislation. An increase of this magnitude would seriously damage the competitive position and cause a loss of jobs not only at Ravenswood, where we employ approximately 2900 people at full operation, but also at fabrication plants in Ohio and other eastern states that receive metal from Ravenswood.

The Ravenswood facilities now constitute Kaiser Aluminum's largest production complex in the world. The smelter portion was reactivated in the latter half of 1983 after an 18-month closedown due to excessive production costs. Kaiser Aluminum and the United Steelworkers of America negotiated major revisions of work practices and other agreements during this period to increase labor productivity and to return the plant to competitive status. Increases in Ravenswood's electricity rates approaching the magnitude estimated would nullify the labor productivity and other production gains made by Kaiser and the Steelworkers through sacrifices by both labor and management.

The future of the Ravenswood smelter is unquestionably linked to the acid rain issue. Under the currently proposed legislation, and depending upon how the emission reductions are implemented, the smelter at Ravenswood would at best be "swing capacity" operated only when aluminum demand is high.

Kaiser Aluminum is painfully aware of energy cost competition in the aluminum industry. In February 1983 we completely shut down our Chalmette, Louisiana smelter because its energy costs were no longer competitive. This plant was once the largest aluminum smelter in North America, employing nearly 3000 workers.

Kaiser also owns smelters in Spokane and Tacoma, Washington that have been hard hit by rapid rate increases imposed by the Bonneville Power Administration. Rates for direct service customers on that system have increased from 3 mills in 1979 to 26.8 mills today. This increase caused many aluminum smelters in the region to become "swing capacity".

Some in Congress have proposed a nationwide acid deposition tax of one mill per kilowatt hour. Adding one mill to BPA's power rate would represent approximately a four percent increase in power costs and would further damage the competitiveness of these already "swing" U.S. facilities.

I will close by saying, we in the aluminum industry do not believe you will recommend legislation designed to solve one problem by creating another of intolerable proportions. I should add that an electricity surcharge to provide capital for controls in no way solves our problem. All that does is shift part of the cost and leaves the user in the same position I have already described.

Further, proposals to "cap" sulfur dioxide emissions are likely to have negative economic impacts on future development of production facilities and energy sources. Such proposals raise serious questions concerning future growth and conversion to coal within the 31-state region. This would be especially important in states like Louisiana which are converting to coal from oil and natural gas.

The aluminum industry strongly urges this Committee and all of Congress to carefully factor in the potential loss of jobs, the loss of economic wealth and the loss of basic U.S. industry as it considers acid rain legislation.

Thank you again for granting me the opportunity to testify.

The Adirondack Council
P.O. Box D-2
Elizabethtown, New York 12932
Phone (518)873-2240

OFFICERS
Frances Beinecke
Chairwoman
Arthur M. Crocker
Vice-Chairman
Barbara Glaser
Secretary
Timothy L. Barnett
Treasurer

BOARD OF DIRECTORS
Timothy L. Barnett
Richard Beamish
Frances Beinecke
Peter A. A. Berle
Richard Booth
Thomas Cobb
Dean Cook
Arthur M. Crocker
James Dawson
Marilyn M. DuBois
Edward D. Earl
Lynne T. Edgerton
Kim Elliman
John Ernst
Barbara Glaser
William T. Hord
Harold A. Jerry, Jr
Sally Johnson
Richard W. Lawrence, Jr
James Marshall
Clarence A. Petty
James Rogers III
Paul Schaefer
Gene Setzer
David Sive

Executive Director
George D. Davis

Testimony of
GEORGE D. DAVIS, EXECUTIVE DIRECTOR
of
THE ADIRONDACK COUNCIL, INC.
ELIZABETHTOWN, NEW YORK

before the
COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

at the
HART SENATE OFFICE BUILDING
WASHINGTON, D.C.

February 10, 1984

Member Organizations: The Association for the Protection of the Adirondacks, National Audubon Society, The Natural Resources Defense Council, The Wilderness Society

I AM GEORGE DAVIS, EXECUTIVE DIRECTOR OF THE ADIRONDACK COUNCIL, LOCATED IN ELIZABETHTOWN, NEW YORK, IN THE HEART OF THE ADIRONDACK PARK. MY EDUCATION AND WORK EXPERIENCE HAVE BEEN IN THE FIELDS OF FORESTRY AND NATURAL RESOURCE MANAGEMENT.

THE ADIRONDACK COUNCIL IS A NON-PROFIT ENVIRONMENTAL ORGANIZATION CONCERNED WITH THE FUTURE OF THE SIX MILLION ACRE ADIRONDACK PARK, ITS NATURAL RESOURCES AND ITS PEOPLE. THE COUNCIL HAS APPROXIMATELY 3,000 INDIVIDUAL MEMBERS AND ALSO REPRESENTS A COALITION OF FIVE CONSERVATION ORGANIZATIONS (THE: ASSOCIATION FOR THE PROTECTION OF THE ADIRONDACKS, NATIONAL AUDUBON SOCIETY, NATIONAL PARKS AND CONSERVATION ASSOCIATION, NATURAL RESOURCES DEFENSE COUNCIL, WILDERNESS SOCIETY) WITH A COMBINED MEMBERSHIP OF MORE THAN 600,000; 65,000 OF WHOM ARE NEW YORK CITIZENS. THE COUNCIL IS THE PRINCIPAL ORGANIZATION DEDICATED TO LAND STEWARDSHIP AND ENVIRONMENTAL ADVOCACY IN THE ADIRONDACK PARK.

THE ADIRONDACK PARK IS COMPRISED OF A MIXTURE OF STATE AND PRIVATE LANDS: IT IS LARGER THAN THE FIVE LARGEST NATIONAL PARKS COMBINED OR THE ENTIRE STATE OF VERMONT. THE PARK INCLUDES OVER 2,800 LAKES AND PONDS, 30,000 MILES OF RIVERS AND STREAMS, AND THE LARGEST WILDERNESS AREA IN THE EASTERN UNITED STATES. THE 120,000 PERMANENT RESIDENTS AND 9 MILLION YEARLY VISITORS TO THE PARK HAVE REASON TO BE ALARMED FOR THIS MAGNIFICENT AREA HAS ALREADY LOST 212 OF ITS LAKES TO THE EFFECTS OF ACID RAIN (CLASSIFIED AS CRITICALLY ACIDIC WITH A pH BELOW 5) AND 256 MORE LAKES ARE PRESENTLY CLASSIFIED AS ENDANGFRED (BELOW pH 6).

THE TERRESTRIAL AND HUMAN HEALTH EFFECTS OF ACID RAIN ARE LESS WELL KNOWN THAN THE AQUATIC EFFECTS, BUT THE POTENTIAL FOR DAMAGE IS EVEN GREATER. STUDIES THROUGHOUT EUROPE SHOW SIGNIFICANT DAMAGE TO FORESTS AND THE SAME APPEARS TO BE HAPPENING IN THE ADIRONDACKS, VERMONT AND ELSEWHERE IN THIS COUNTRY.

IT IS IRONIC THAT THE ADIRONDACKS, A REGION RENOWN FOR ITS NATURALNESS SHOULD HAVE BEEN THE FIRST AREA IN THE UNITED STATES TO CLEARLY SHOW THE DEVASTATING EFFECTS OF ACID DEPOSITION. BUT ALTHOUGH THE ADIRONDACKS MAY HAVE BROUGHT THE ISSUE OF ACID RAIN HOME TO MANY OF US, IT CAN NOW BE SHOWN THAT THE ADIRONDACK EXPERIENCE WAS MERELY A HARBINGER OF THINGS TO COME ELSEWHERE.

ACIDIFICATION OF WATERS HAS BEEN NOTED IN PENNSYLVANIA, THE NEW JERSEY PINE BARRENS, THE APPALACHIAN MOUNTAINS OF MARYLAND AND NORTH CAROLINA, THE BERKSHIRES IN MASSACHUSETTS, THE GREEN MOUNTAINS IN VERMONT, THE WHITE MOUNTAINS IN NEW HAMPSHIRE, AND THE LAKE COUNTRY IN MINNESOTA. THE ROCKIES AND OTHER AREAS ARE ALSO SUFFERING FROM ACID RAIN. THE EARLY DEATH OF ADIRONDACK LAKES SERVES AS A WARNING TO THE REST OF THE COUNTRY OF THE GRIM FATE THAT AWAITS US IF WE DO NOTHING TO STOP ACID RAIN.

WE ARE SORELY DISAPPOINTED IN THE ADMINISTRATION'S REFUSAL TO CALL FOR AN ACID RAIN CLEANUP PROGRAM THIS YEAR: INSTEAD THEY STALL BY CALLING FOR MORE RESEARCH. THE SCIENTIFIC DEBATE OVER ACID RAIN IMPACTS SHOULD HAVE ENDED LAST YEAR WITH CONCLUSIVE REPORTS FROM BOTH THE NATIONAL ACADEMY OF SCIENCES AND THE PRESIDENT'S OWN PANEL OF SCIENTISTS; IT IS TIME NOW TO FOCUS ON CONTROL PROGRAMS.

I WOULD LIKE TO THANK SENATOR STAFFORD AND HIS COMMITTEE FOR THIS OPPORTUNITY TO ADDRESS THE ISSUES ARISING FROM HIS PROPOSED AMENDMENTS TO THE FEDERAL CLEAN AIR ACT. I TRUST THAT THE SENATE IS READY TO MOVE FORWARD AND FILL THE LEADERSHIP GAP LEFT BY THE ADMINISTRATION IN THIS IMPORTANT AREA.

ACID PRECURSOR CONTROLS

SENATE BILL 768 SEEKS TO REDUCE THE ANNUAL EMISSIONS OF SULFUR DIOXIDE BY 8 MILLION TONS BY 1995. THIS MANDATE WOULD BE SUPPLEMENTED BY AN

EMISSIONS CAP ON BOTH SULFUR DIOXIDE AND NITROGEN OXIDES REQUIRING AN OFFSET OF ANY NEW EMISSIONS WITH COMPENSATING REDUCTIONS, THEREBY GUARDING AGAINST FUTURE INCREASES. THE RESULT OF THESE EMISSION CONTROLS WOULD BE A 35% REDUCTION IN THE 1980 LEVEL OF EMISSIONS IN SULFUR DIOXIDE.

THE 1983 REPORT OF THE NATIONAL ACADEMY OF SCIENCES CONCLUDED THAT A 50% REDUCTION IN SULFUR DIOXIDE EMISSIONS IS NEEDED TO PREVENT FURTHER DAMAGE BY ACID DEPOSITION. SEVERAL STUDIES INDICATE THAT A 12 MILLION TON REDUCTION IN SULFUR DIOXIDE EMISSIONS WOULD BE NECESSARY TO ACHIEVE THE 50% EMISSION REDUCTION GOAL. EVEN THIS WOULD NOT BRING THE RATE OF ACID DEPOSITION DOWN TO A LEVEL THAT CAN BE ADEQUATELY BUFFERED BY ALL SOILS, BUT IT WOULD BE A MAJOR STEP FORWARD.

IN LIGHT OF THE SCIENTIFIC ANALYSIS OF ACID RAIN IMPACTS, THE ADIRONDACK COUNCIL, WHILE APPLAUDING THE COMMITTEE FOR ITS FINE WORK IN DEVELOPING SENATE BILL 768, RESPECTFULLY URGES YOU TO INCREASE THE REQUIRED ANNUAL SULFUR DIOXIDE REDUCTION TO AT LEAST 12 MILLION TONS AND TO REACH THAT OBJECTIVE WITHIN TEN YEARS. THE TECHNOLOGY EXISTS, THE PUBLIC SUPPORT EXISTS, WE NEED ONLY YOUR DETERMINATION, DIRECTION AND LEADERSHIP.

NITROGEN OXIDE EFFECTS ARE OFTEN OVERLOOKED, YET THEY CONTRIBUTE SUBSTANTIALLY TO THE CAUSES OF ACIDIFICATION ESPECIALLY TO THE SPRING SHOCK EFFECT DURING PERIODS OF SNOWMELT. THE COUNCIL SUPPORTS LIMITS ON NITROGEN OXIDE EMISSIONS, BUT WE FEEL THAT SULFUR DIOXIDE EMISSIONS REDUCTIONS SHOULD NOT BE COMPROMISED BY ALLOWING SUBSTITUTION OF NITROGEN OXIDE EMISSIONS REDUCTIONS.

EMISSION REDUCTION METHODS

IN TESTIMONY LATE LAST YEAR BEFORE REPRESENTATIVE WAXMAN'S SUBCOMMITTEE ON HEALTH AND THE ENVIRONMENT, THE ADIRONDACK COUNCIL SUPPORTED PROVISIONS OF HOUSE BILL 3400 THAT WOULD REQUIRE THE INSTALLATION OF FLUE GAS DESULFURIZATION UNITS (SCRUBBERS). WE DID SO BECAUSE WE BELIEVE THIS IS A FEASIBLE

METHOD TO PROTECT JOBS AND REGIONAL EMPLOYMENT INTEGRITY. IT WOULD TEMPER EMPLOYMENT SHIFTS FROM HIGH SULFUR COAL PRODUCING REGIONS TO LOW SULFUR COAL REGIONS.

THERE MAY BE OTHER MEANS AVAILABLE TO AVOID POTENTIAL EMPLOYMENT IMPACTS AND IF SO WE ARE OPEN TO THEM. AS ENVIRONMENTALISTS WE ARE CONCERNED WITH THE TOTAL ENVIRONMENT: HUMAN AND NATURAL RESOURCES. IT IS DIFFICULT, IF NOT IMPOSSIBLE, TO BE "ENVIRONMENTALLY AWARE" AND AT THE SAME TIME UNEMPLOYED.

COST DISTRIBUTION

A RECENT POLL OF NEW YORK STATE RESIDENTS CONDUCTED BY RESEARCHERS FOR THE STATE UNIVERSITY OF NEW YORK AND THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SHOWED -- NOT SURPRISINGLY -- THAT THEY ARE OVERWHELMINGLY IN FAVOR OF COMPREHENSIVE ACID RAIN CONTROLS. THE SURPRISING ELEMENT OF THE SURVEY, HOWEVER, WAS THAT EVEN THOUGH NEW YORK RESIDENTS ARE ALREADY PAYING SOME OF THE HIGHEST UTILITY RATES IN THE COUNTRY THEY ARE IN FAVOR OF STRONG ACID RAIN CONTROL MEASURES EVEN IF IT MEANS AN INCREASE IN THEIR OWN ELECTRIC BILLS. THIS POINT HAS BEEN MADE REPEATEDLY BY PUBLIC OPINION POLLS; THE PEOPLE OF THIS NATION ARE WILLING TO PAY TO HAVE CLEAN AIR AND CLEAN WATER.

SUMMARY

1984 IS THE YEAR WE MUST MOVE AHEAD ON ACID DEPOSITION CONTROL LEGISLATION. WE CANNOT AFFORD TO FURTHER ENDANGER OUR NATION'S HEALTH, WATER, FORESTS AND SOIL PRODUCTIVITY. THE ADIRONDACK COUNCIL IS PLEASED TO BE GIVEN THE OPPORTUNITY TO TESTIFY ON SENATE BILL 768. WE COMMEND SENATOR STAFFORD AND SUPPORT HIS UNTIRING EFFORTS TO MOVE TOWARD LEGISLATION THIS YEAR THAT WOULD HELP PROTECT THIS PLANET FROM THE INSIDIOUS MENACE OF ACID RAIN.

THANK YOU.

TESTIMONY
OF
GEORGE H. LAWRENCE, PRESIDENT OF THE
AMERICAN GAS ASSOCIATION
BEFORE THE SENATE ENVIRONMENT AND PUBLIC WORKS' COMMITTEE
ON METHODS TO REDUCE SO_2

February 10, 1984

Introduction

Mr. Chairman and members of the Committee:

I am George H. Lawrence, President of the American Gas Association. A.G.A. is a national trade association composed of nearly 300 natural gas distribution and transmission companies serving over 160 million U.S. consumers. On behalf of both our members and our consumers, I would like to put before this Committee an easily implemented and economical technique of reducing sulfur oxide air pollution. Our strategy is called the Select Use of natural gas. It involves mixing natural gas -- which emits virtually no sulfur oxides when burned -- with more polluting fuels, such as coal or high sulfur oil. Clean burning natural gas can offset or reduce the amount of air pollution that would have been emitted if just coal or high sulfur oil were burned.

Many bills have been introduced in both the House and the Senate to reduce sulfur oxide emissions. Some of these bills require specific control strategies, typically flue gas desulfurization, i.e., scrubbers. While we do not denigrate the goals of any of these bills, we disagree strongly with those that require a single solution. We believe that:

(1) Sulfur oxide reductions should be achieved with performance standards, leaving the plant operator free to choose the most efficient control strategy for the particular plant; and

(2) Calculations that purport to show that sulfur oxide controls will cost X or Y, and that are based on a single control strategy, are not useful.

The most efficient control strategy for a particular plant depends on factors at that plant. As long as environmental goals are met, it makes sense to let the plant operator choose the control strategy that best fits the plant. Select use of gas, low sulfur coal blending, coal washing, scrubbers, and other strategies each have a place.

What Is Select Use?: An Explanation of the Strategy

Natural gas is an extremely clean burning fuel. It emits virtually no sulfur oxides or particulates when burned. Its carbon dioxide, carbon monoxide, nitrogen oxide, and non-methane hydrocarbon emissions are all lower than oil or coal. For example, a large gas boiler (either industrial or power plant) on average emits only .0006 pounds of SO_2 per MMBtu, while a boiler on an average grade of residual fuel oil (1.5% sulfur) emits 1.6 lbs SO_2/MMBtu. A similar boiler operating on 2% sulfur coal emits 3.4 lbs/SO_2/MMBtu. In a well-known case, the Narragansett Electric Company in Rhode Island used the clean burning attributes of natural gas to offset emissions from a switch to a higher sulfur oil. In the past, the utility operated two boilers on expensive low sulfur oil. In order to reduce fuel costs, it switched one boiler to high sulfur oil and the other to natural gas. By converting a single boiler to gas, the company was able to offset the increased SO_2 from the high sulfur oil and actually reduced both its fuel cost by $2 million a year and its SO_2 emissions by 1,388 tons/year. This same strategy can be used with Eastern high sulfur or Western low sulfur coal. The following charts show the amount of natural gas (in percentages) that could be used with coal or oil, with varying sulfur contents. The percentages vary, of course, with the stringency of local limits on SO_2 emissions (shown on the left axis). These data show the significant environmental benefits of using natural gas.

PERCENTAGE OF FUEL MIX REQUIRED TO BE GAS FOR VARIOUS GRADES OF COAL AND SO_2 EMISSION LEVELS

SO_2 SIP (lb./MMBtu)	Sulfur Content of Eastern Coal[2]				Sulfur Content of Western Coal[3]			
	.8%	1%	2%	3%	.8%	1%	2%	3%
0.6	53%	62%	81%	87%	61%	68%	84%	89%
0.8	37	49	75	83	47	58	79	86
1.0	22	37	68	79	34	47	74	82
1.2	6	24	62	75	21	37	68	79
1.4	–	11	56	71	8	26	63	75
1.6	–	–	50	66	–	16	58	72
1.8	–	–	43	62	–	5	53	68
2.0	–	–	37	58	–	–	47	65
2.2	–	–	31	54	–	–	42	61
2.4	–	–	24	49	–	–	37	58
2.6	–	–	18	45	–	–	32	54
2.8	–	–	12	41	–	–	26	51
3.0	–	–	5	37	–	–	21	47

---

[1] *Select Gas Use for Environmental Purposes*, American Gas Association 20 (January, 1983).

[2] 12,000 Btu/lb.

[3] 10,000 Btu/lb.

PERCENTAGE OF FUEL MIX REQUIRED TO BE GAS FOR[1] VARIOUS GRADES OF RESIDUAL OIL AND SO_2 EMISSION LEVELS

SO_2 SIP	Sulfur Content of Oil				
(lb./MMBtu	.25%	.5%	1%	2%	3%
0.2	23%	62%	81%	90%	94%
0.4	–	23	62	81	87
0.6	–	–	43	71	81
0.8	–	–	24	62	75
1.0	–	–	5	52	68
1.2	–	–	–	43	62
1.4	–	–	–	33	56
1.6	–	–	–	24	49
1.8	–	–	–	14	43
2.0	–	–	–	5	37
2.2	–	–	–	–	30
2.4	–	–	–	–	24
2.6	–	–	–	–	17
2.8	–	–	–	–	11
3.0	–	–	–	–	5

---

[1] *Select Gas Use For Environmental Purposes*, American Gas Association 21 (January, 1983).

Choosing the Most Efficient Sulfur Oxide Control Strategy: The Benefits of Natural Gas

With select use of gas, the cost of sulfur oxide reductions can vary from \$50/ton of SO_2 removed to over \$1000/ton. This range of costs is not unusual considering the many variables, such as state set emission limits, and fuel and equipment costs, which can change dramatically from site to site. A study by ICF, Inc. a consulting firm, postulated a range of control costs for fuel switching (high to low sulfur coal or oil) and scrubbing from \$250 - \$2000/ton. When one considers that many select use options fall in the \$200 - \$400/ton range, the reader can immediately see that gas and coal or gas and high sulfur oil mixtures are economical alternatives to scrubbing or fuel switching.

For completeness, the ICF \$250 - \$2000 cost range for non-select use control options is:

Representative Annualized Costs of SO_2 Reduction Alternatives*

Control Strategy	\$/ton SO2 Removal (mid-1982 dollars)
Shift from High- to Low-Sulfur Coal**	\$ 250 - \$ 300
Shift from High- to Medium-Sulfur Coal**	350 - 400
Shift from Medium- to Low-Sulfur Coal**	400 - 450
Shift from High- to Low-Sulfur Residual Oil	450 - 600
Shift from Unscrubbed to Scrubbed High Sulfur Coal***	400 - 500
Shift from Unscrubbed to Scrubbed Midium-Sulfur Coal***	600 - 1,100
Shift from Unscrubbed to Scrubbed Low-Sulfur Coal***	1,200 - 2,000

---

*Cost will vary considerably, depending upon region and plant size. Costs per ton presented in this table are intended to be representative of average control costs only.

**Costs include upgrading particulate removal equipment.

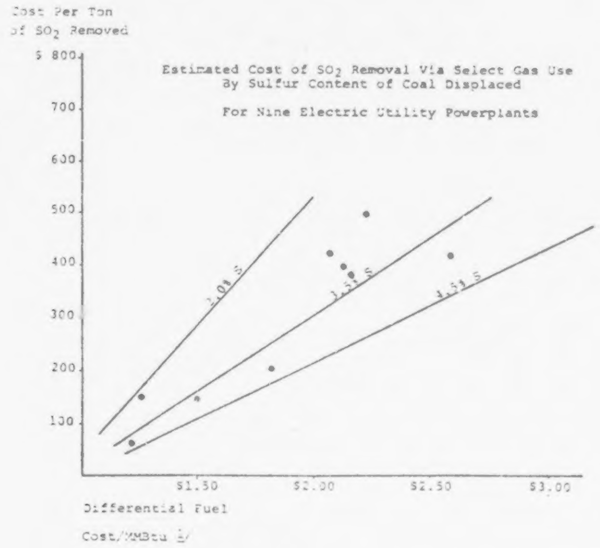
***Based on retrofit scrubbing costs for a 500-megawatt powerplant.

Source: ICF, Incorporated

We think, however, that ICF may have understated the costs of a massive switch to low sulfur coal. For example, the model tends to understate the costs of increased rail transportation. Also, the other effects of fuel switching need to be considered. These include unemployment in Eastern coal mines, plant derating, and increased solid waste disposal.

In many situations, but not in all or even necessarily most, select use can be the most economical control option. In addition to the quantifiable benefits of Select Use, we should also mention its intangible benefits. For example, Select Use is a flexible control strategy that can be combined easily with other technologies. Select Use and low cost coal washing could reduce SO_2 by 50% or more while continuing to use 70% or more of Eastern high sulfur coal. This is in sharp contrast to low sulfur coal fuel switching which could cut Eastern coal consumption to 25%, in the worst case.

Although the immediately preceding pages have been devoted to Select Use with coal, natural gas mixtures are also an excellent way to lower high sulfur oil emissions. There are hundreds of power plants and industrial facilities that could use gas/oil mixtures either in adjacent boilers, or in the same boiler. Professor Alex Green of the Interdisciplinary Center for Aeronomy and Atmospheric Sciences at the University of Florida estimated in 1980 that consumers could save $12.5 billion per year in electricity costs by switching 100% oil-fired powerplants to gas mixtures. (While the Green work is becoming dated, the bottom line is still clear: the potential savings are large.) The following chart graphically displays the site specific benefits of select use at nine powerplants.



1/ Cost of Gas - Cost of Coal

Note: Assumes O&M of coal-fired utility boiler exceeds gas boiler O&M by $1.00/mmBtu based on information contained in: Thermal-Electric Plant Construction Cost and Annual Production Expenses, DOE/EIA.

● - Represents actual plant operating data (cost of gas, cost of coal, sulfur content of coal) for December, 1982. See: Cost and Quality of Fuels for Electric Utility Plants, DOE/EIA.

Select Use Is a Feasible and Well-Proven Technology

A special advantage of Select Use is that it can be implemented quickly, with very low capital costs. One possible research project which would reduce SO_2 emissions quickly involves the implementation of the Select Use concept on an interim basis. By employing a select use sulfur oxide control strategy on an interim basis, any changes in the acidity of rain and lakes could be monitored and any cause and effect relationships between emissions and this acidity could be better assessed. This strategy avoids the long lead times and large investments for major pollution control equipment, as well as the economic dislocations of high to low sulfur coal switching. It also preserves future SO_2 control options so that -- _if_ research pinpoints acid rain sources -- flexibility is retained as to the optimum permanent course to pursue.

A.G.A. recently compiled a list of facilities that use some mixture of natural gas and another fuel. This tabulation shows that Select Use is a control strategy that we can use here and now.

Examples of Select Gas Use Applications

State	Company	Gas Used in Conjunction With
NJ	Atlantic City Electric [1/]	Coal
MA	Boston Edison	Oil
RI	Narragansett Electric	Oil
PA	Andre's Greenhouse	Oil
AL	3M	Oil
CT	Uniroyal	Oil
VT	Burlington Electric	Oil
PA	U. S. Steel	Coal
PA	Scott Paper	Oil
PA	Arbogast & Bastian	Oil
PA	J. H. Thompson	Oil
PA	U. S. Steel	2/
PA	Bellefield Boilers	Coal
MO	Springfield Utilities	Coal
NJ	Public Service Electric and Gas	Coal

1/ Company operated on a 50:50 gas/coal mix from 1980 through 1932 for SO_2 control while scrubbers were being installed; no longer using gas.

2/ Natural gas used to offset SO_2 emissions from various coke ovens, soaking pits, boilers, furnaces and other steel industry operations.

Natural Gas Supplies Are Abundant: The Gas Industry Is Well Able To Satisfy The Select Use Market.

If plant operators can choose Select Use, as one of many options, as much as 1 Tcf/year of natural gas might ultimately be used for environmental compliance. Nationally, the natural gas industry is quite capable of supplying this market. 1 Tcf/year is only approximately 5% of current or projected yearly U.S. production. At the present time, we estimate that the U.S. has as much as 3-4 Tcf excess deliverability: that is, gas shut-in or not taken. A 1 Tcf investment could translate into a 2 million ton/yr. SO_2 reduction. By combining Select Use with coal washing, that same 1 Tcf could reduce SO2 by nearly 4 million tons/year. This strategy also reduces NO_2 and particulate emissions, as well as solid wastes.

Furthermore, future gas supplies are ample. A.G.A.'s Gas Supply Committee - which is made up of a broad spectrum of gas industry experts -- recently revised our independent supply forecast for the end of this century. The Committee considered three different policies:

- North American Self-Sufficiency, in which the nation relies entirely on lower 48 state resources, Alaskan gas, and Canadian and Mexican imports;
- High Alternative Fuel Prices, in which world crude oil prices rise somewhat rapidly, thus pushing-up gas prices; and
- Low Alternative Fuel Prices, in which world crude oil prices rise less rapdily, thus restraining gas prices.

In each and every case, gas supplies were adequate in the year 2000. The average supply estimate for the three scenarios, which appear below, is 22.4 Tcf in 2000 -- an increase of 20% over actual gas supplies in 1982.

TABLE I-1
GAS SUPPLY-2000
(in Tcf)

Scenarios	**Self-Sufficiency**	**High-Price Alternative Fuels**	**Low-Price Alternative Fuels**
Conventional Lower-48	15-16	14-15	12-13
Incremental Tight Formations	2-3	1-3	0.3-1.5
Total Lower-48	17-19	15-18	12.3-14.5
Alaska	1.4	0.9	0.8
Canada	2.4	2.4	1.5
Mexico	1.5	1.0	1.5
LNG	0.2	1.0	0.2
Coal Gas	1.5	1.0	0.3
SNG	0.1	0.1	0.2
Nonconventional	0.6	0.4	0.2
Totals	**24.7-26.7**	**21.8-24.8**	**17.0-19.2**

It is important to note that our revision considered the following "economic realities": (a) a slowdown in the rate of economic growth, factoring in uncertain interest rates; (b) declining U. S. demand for all forms of energy, due to conservation and increasingly efficient processes; and (c) a new slant towards conventional oil and gas supplies and away from synthetic fuels.

Although these three factors may all operate to check gas supplies, the overall forecast still reveals a healthy range of gas supplies from a low of 17 Tcf to a high of 26.7 Tcf.

Summary

The benefits of multiple control strategies for SO_x reductions are many. Select Use, in particular:

- Maximizes the use of Eastern coal and minimizes the economic and social dislocations among mining communities;
- Avoids plant derating, increased solid waste, increased particulates, and railroad transportation problems associated with straight coal strategies;
- Offers prompt emission reductions since new equipment or plant modifications are minimal in most cases.
- Can buy the nation valuable time since Select Use can be used temporarily to reduce emissions quickly while research is ongoing; and
- Avoids the high capital costs of a mandatory scrubber program.

With myriad benefits, Select Use is a vital alternative for the nation to consider. Now is the time to take advantage of the environmental benefits of our cleanest burning fossil fuel, a long term adequate supply of which appears very attainable. We can do that by: (1) repealing incremental pricing and the Fuel Use Act ban on gas use by powerplants and industry; (2) ensuring that if SO_2 control legislation is enacted, it mandates performance standards rather than specific fuels or control strategies; and (3) urging the Environmental Protection Agency to accept Select Use as a control technology under existing provisions of the Clean Air Act.

CELANESE

STATEMENT BY

HARRY W. BUCHANAN

VICE PRESIDENT - CELANESE CORPORATION

BEFORE THE SENATE

ENVIRONMENT AND PUBLIC WORKS COMMITTEE

HEARING ON ACID RAIN

FEBRUARY 10, 1984, WASHINGTON, D.C.

CELANESE CORPORATION • 1211 AVENUE OF THE AMERICAS, NEW YORK, N.Y. 10036 • TELEPHONE: 212-719-8000

CHAIRMAN STAFFORD, DISTINGUISHED COMMITTEE MEMBERS, LADIES AND GENTLEMEN.

MY NAME IS HARRY BUCHANAN. I AM VICE PRESIDENT OF CELANESE CORPORATION, A MAJOR PRODUCER OF CHEMICALS, FIBERS AND SPECIALTIES AND THE WORLD'S LARGEST PRODUCER OF METHANOL.

I APPRECIATE THE OPPORTUNITY TO APPEAR BEFORE YOU ON A SUBJECT -- ACID RAIN -- WHICH IS ONE OF THE MOST CHALLENGING ENVIRONMENTAL ISSUES FACING OUR NATION. IT IS A VERY COMPLEX PHENOMENON WHICH APPEARS TO BE CAUSED BY SEVERAL FACTORS. WE ALSO RECOGNIZE THAT IT'S A VERY DIFFICULT POLITICAL ISSUE.

I APPEAR BEFORE YOU TODAY NOT AS AN EXPERT ON ACID RAIN, OR TO PROPOSE A TOTAL SOLUTION TO THIS ISSUE, RATHER, I WISH TO REVIEW FOR THE COMMITTEE A GROWING BODY OF EVIDENCE THAT SUGGESTS THE USE OF METHANOL AS AN ALTERNATIVE FUEL IN A NUMBER OF DIFFERENT APPLICATIONS COULD PLAY A ROLE IN THIS NATION'S OVERALL ACID RAIN STRATEGY. SPECIFICALLY, METHANOL -- WHEN USED AS A FUEL -- COULD HELP REDUCE EMISSIONS OF NITROGEN OXIDES AND, TO A LESSER DEGREE, SULFUR DIOXIDE, BOTH OF WHICH HAVE BEEN IDENTIFIED AS THE MAJOR PRECURSORS OF ACID RAIN.

METHANOL, THE SIMPLEST OF ALL ALCOHOLS, IS ANOTHER NAME FOR METHYL OR WOOD ALCOHOL. THIS DIFFERS FROM ETHANOL, OR ETHYL ALCOHOL, THE MAIN INGREDIENT OF ALCOHOLIC BEVERAGES. ALTHOUGH METHANOL HAS BEEN AROUND SINCE THE 1600'S, WE AT CELANESE HAVE PRODUCED IT SINCE 1946, PRIMARILY FOR USE AS A BASIC INTERMEDIATE CHEMICAL IN THOUSANDS OF PRODUCTS WE ALL USE, SUCH AS PAINTS, SHELLACS, FLOOR COVERINGS, TEXTILES, PLYWOOD, GLUES, COSMETICS AND PHARMACEUTICALS.

WE FEEL THAT THE FAVORABLE ENVIRONMENTAL BENEFITS OF METHANOL ARE KEY REASONS FOR ITS GROWING POPULARITY AS A TRANSPORTATION FUEL. LET ME DESCRIBE IN MORE DETAIL SOME OF THE WAYS IN WHICH METHANOL CAN REDUCE EMISSIONS OF NITROGEN OXIDES AND SULFUR DIOXIDE AND, HOPEFULLY, CONTRIBUTE TO THE CONTROL OF ACID RAIN.

AT THIS MOMENT, A GENERAL MOTORS METHANOL BUS -- THE FIRST OF ITS KIND IN THE U.S. -- IS IN THE FIRST PHASE OF A YEAR-LONG EVALUATION PROGRAM IN REVENUE SERVICE ACROSS THE GOLDEN GATE BRIDGE IN SAN FRANCISCO. THROUGHOUT CALIFORNIA, THE STATE'S 506 NEW FACTORY-PRODUCED FORD METHANOL ESCORTS ARE BEING USED TO CONDUCT STATE AND LOCAL GOVERNMENT BUSINESS AS USUAL. THESE CARS ARE FUELED AT AN INCREASING NUMBER OF METHANOL GAS STATIONS STRETCHING FROM SAN DIEGO TO SAN FRANCISCO. IN THE PRIVATE SECTOR, THE BANK OF AMERICA ANNOUNCED THE SUCCESSFUL CONVERSION OF OVER 200 OF ITS FLEET VEHICLES TO RUN ON NEAT METHANOL. THEY'VE NOW LOGGED SEVERAL MILLION MILES AND REPORT EXCELLENT RESULTS.

- more -

ON THE NATIONAL LEVEL, THE EPA'S OFFICE OF MOBILE SOURCES IN ANN ARBOR, MICHIGAN, IS CONTINUING TO STUDY METHANOL AS A FUEL. THE AGENCY'S FINDINGS CONCLUDE THAT "WITH RESPECT TO NITROGEN OXIDE AND PARTICULATE EMISSIONS, METHANOL-FUELED VEHICLES OFFER THE GREATEST BENEFITS".

FURTHERMORE, ANY HYDROCARBONS THAT ARE PRODUCED ARE BELIEVED TO BE MUCH LESS PHOTOCHEMICALLY REACTIVE. IT IS THE LATTER, OF COURSE, WHICH ARE SAID TO CONTRIBUTE TO URBAN SMOG.

ON THE INTERNATIONAL LEVEL, THE WEST GERMAN GOVERNMENT IS INITIATING A MUCH ENLARGED EVALUATION PROGRAM INVOLVING A TEST FLEET OF THREE HUNDRED NEAT METHANOL-FUELED CARS AND LIGHT DUTY VEHICLES. THIS IS A UNIQUE EXAMPLE OF THE PARTNERSHIP THAT EXISTS IN EUROPE BETWEEN PRIVATE INDUSTRY AND GOVERNMENT. IN THE FAR EAST, WE'RE AWARE THAT JAPANESE AUTOMAKERS ARE BUSILY TESTING METHANOL ENGINES TO KEEP THEIR INDUSTRY ON THE LEADING EDGE OF TECHNOLOGY.

METHANOL FUELS ALSO HAVE THE POTENTIAL TO SUCCESSFULLY REDUCE AIR POLLUTION FROM STATIONARY SOURCES, SUCH AS VARIOUS TYPES OF GAS TURBINE ELECTRICAL GENERATORS. TESTS CONDUCTED AT A MAJOR UTILITY COMPANY HAVE SHOWN THAT THERE IS A SIGNIFICANT NITROGEN OXIDE REDUCTION OVER NATURAL GAS IN LOAD-FOLLOWING UTILITY TURBINES. THERE IS ALSO PRELIMINARY EVIDENCE THAT METHANOL IN STATIONARY BOILERS -- THROUGH A PROCESS KNOWN AS OVERFIRING -- COULD HAVE A SIGNIFICANT ENVIRONMENTAL IMPACT.

- more -

OVERFIRING IS A PROCESS WHERE METHANOL IS BURNED IN SMALL QUANTITIES OVER A FUEL, SUCH AS NORMAL UTILITY-GRADE FUEL OIL. THE NET RESULT IS REDUCED EMISSIONS, PARTICULARLY NITROGEN OXIDES. THERE ARE VARIOUS TECHNICAL REASONS FOR THIS EFFECT: FIRST, METHANOL ITSELF IS NITROGEN AND SULFUR FREE. MORE IMPORTANTLY, SINCE METHANOL BURNS AT A MUCH COOLER TEMPERATURE, IT TENDS TO REDUCE NITROGEN OXIDES.

OBVIOUSLY, WHAT IS NEEDED NOW IS A LARGE-SCALE OVERFIRING DEMONSTRATION IN AN OIL-FIRED BURNER TO ANALYZE ACTUAL FIELD TEST RESULTS. ANY FEDERAL ACTION AND LEADERSHIP IN THIS REGARD WOULD BE A MAJOR STEP TOWARD PROVING THE POTENTIAL BENEFICIAL ENVIRONMENTAL IMPACT OF METHANOL OVERFIRING IN LARGE UTILITY AND INDUSTRIAL BOILERS. THERE IS A BODY OF OPINION THAT BELIEVES THE SAME OVERFIRING BENEFITS ACHIEVED BY BURNING METHANOL IN AN OIL-FIRED BURNER COULD HAVE A BENEFICIAL ENVIRONMENTAL EFFECT IN COAL-FIRED BURNERS. THIS THEORY ALSO SHOULD BE EXPLORED FOR ITS POTENTIAL BENEFIT IN NITROGEN OXIDE REDUCTION.

MR. CHAIRMAN, THE QUESTION MOST EVERYONE RAISES AT THIS POINT IS: WHAT'S HOLDING METHANOL BACK?

I THINK THAT PART OF THE ANSWER IS THAT THE ENVIRONMENTAL AND PERFORMANCE ADVANTAGES OF METHANOL AREN'T WELL-KNOWN, AND THERE'S A WIDESPREAD -- GRANTED, MISTAKEN -- IMPRESSION THAT THERE ISN'T ENOUGH METHANOL AVAILABLE FOR FUEL. THEN, THERE'S THE NORMAL RESISTANCE ANYONE WOULD EXPECT TO FIND WHEN CHANGES TO THE TRADITIONAL TRANSPORTATION AND FUEL SYSTEMS ARE PROPOSED. WE'RE WORKING HARD ON ALL OF THESE PROBLEMS.

- more -

BUT THERE IS A SECOND PART TO THE ANSWER WHICH NEEDS GOVERNMENT ATTENTION. A NUMBER OF FEDERAL LAWS AND REGULATIONS CURRENTLY MAKE IT DIFFICULT FOR METHANOL TO COMPETE EFFECTIVELY AGAINST THE TRADITIONAL TRANSPORTATION FUELS. QUITE UNINTENTIONALLY, THESE RESTRICTIONS IMPEDE THE USE AND DEVELOPMENT OF METHANOL AS A FUEL.

PRESIDENT REAGAN TOOK A MAJOR STEP FORWARD IN THIS AREA RECENTLY WHEN HE APPOINTED A FIFTEEN AGENCY TASK FORCE, CONSISTING OF ASSISTANT SECRETARY-LEVEL STAFF, TO STUDY THE LEGAL BARRIERS HOLDING BACK THE DEVELOPMENT AND TESTING OF METHANOL AS A FUEL IN THE U.S. WE AT CELANESE APPLAUD THE PRESIDENT'S LEADERSHIP AND WE ARE EXTREMELY ENCOURAGED BY THE OVERALL SUPPORT SHOWN BY THE ADMINISTRATION. THE EPA, TOO, IS VIGOROUSLY EXAMINING THESE ISSUES AND WE'RE OPTIMISTIC ABOUT THEIR EFFORTS TO TEST AND MEASURE THE ENVIRONMENTAL EFFECTS OF METHANOL IN SOME OF THE APPLICATIONS I DISCUSSED.

IN CONCLUSION, I WILL OUTLINE SEVERAL STEPS WHICH WE BELIEVE THE FEDERAL GOVERNMENT CAN TAKE TO FACILITATE THE BROADER USE OF THIS CLEAN-BURNING FUEL. FIRST, WE RECOMMEND THE REMOVAL OF CERTAIN PROVISIONS OF EXISTING LAW AND REGULATION WHICH INADVERTENTLY INHIBIT THE DEVELOPMENT OF METHANOL AS A TRANSPORTATION FUEL. THESE INCLUDE:

- o EQUALIZING FEDERAL MOTOR FUELS TAXES SO THAT METHANOL IS TAXED ON AN ENERGY EQUIVALENT BASIS WITH GASOLINE AND DIESEL FUEL,
- o MODIFYING EXISTING REGULATIONS TO FACILITATE CERTIFICATION OF METHANOL VEHICLES, AND

- more -

o MODIFYING CORPORATE AVERAGE FUEL ECONOMY STANDARDS TO ACCURATELY REFLECT THE FUEL ECONOMY OF METHANOL VEHICLES.

SECOND, WE RECOMMEND GOVERNMENT PARTICIPATION IN CERTAIN LIMITED RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACTIVITIES TO DEVELOP METHANOL'S FUEL USE AS A METHOD OF NITROGEN OXIDE REDUCTION THAT WOULD BE OF ASSISTANCE IN AN ACID RAIN CONTROL STRATEGY.

CONGRESS SHOULD WORK TOWARD PROVIDING RESEARCH, DEVELOPMENT AND DEMONSTRATIONS OF METHANOL OVERFIRING TECHNOLOGY WHICH WOULD PROVIDE VITAL OPERATING AND EMISSIONS TEST RESULTS, WHILE FOCUSING NATIONAL ATTENTION ON THE PROJECT AND SPURRING ADDITIONAL JOINT "PRIVATE/PUBLIC" SECTOR TESTING.

CONGRESS SHOULD ALSO SUPPORT EFFORTS BY THE EPA AND DEPARTMENT OF TRANSPORTATION TO PARTICIPATE IN RESEARCH, DEVELOPMENT AND DEMONSTRATION OF METHANOL AS A FUEL FOR DIESEL TRUCKS AND BUSES. THERE IS GROWING EVIDENCE THAT DIESEL EMISSIONS MAY POSE A PUBLIC HEALTH HAZARD, PARTICULARLY IN URBAN AREAS. THE USE OF METHANOL CAN DRAMATICALLY DECREASE NITROGEN OXIDES AND DIESEL SMOKE -- COMMONLY KNOWN AS PARTICULATE EMISSIONS -- WHILE ALLOWING THE USE OF CONVERTERS TO REDUCE OTHER EMISSIONS.

FINALLY, SINCE THE FEDERAL GOVERNMENT IS THE WORLD'S LARGEST FLEET VEHICLE OPERATOR, CONGRESS SHOULD AUTHORIZE THE FEDERAL AGENCIES TO PURCHASE METHANOL CARS, TRUCKS, AND BUSES. USING METHANOL TO FUEL OUR FEDERAL FLEET WOULD SET A NATIONWIDE EXAMPLE OF THE ENVIRONMENTAL, ECONOMIC, AND ENERGY SECURITY BENEFITS THAT CAN BE ACHIEVED THROUGH METHANOL.

- more -

AT CELANESE WE BELIEVE DEVELOPING CLEAN-BURNING ALTERNATE ENERGY SHOULD BE A NATIONAL PRIORITY AND BE PART OF ANY COUNTRYWIDE ACID RAIN CONTROL STRATEGY EMANATING FROM WASHINGTON. ALL EVIDENCE SHOWS THAT THE MOST PROMISING ENVIRONMENTALLY CLEAN FUEL OF THE FUTURE IS METHANOL. IT'S HERE TODAY! THANK YOU.

I'LL BE HAPPY TO ANSWER ANY QUESTIONS.

# # #

Clean Coal Coalition, Inc.
1828 L Street, N.W.
Washington, D.C. 20036
Phone (202) 887-5537

Written Statement
of
Dr. Leon Green, Jr.
Clean Coal Coalition, Inc.
Before
Senate Environment and Public Works Committee
on
Acid Rain Legislation:
Implications for the Future

February 10, 1984

My name is Leon Green, Jr., president of Energy Conversion Alternatives, Ltd. and vice president of the Clean Coal Coalition, Inc. (Coalition). I am accompanied by Michael J. Zimmer, a partner in the Washington, D.C. law firm of Wickwire, Gavin and Gibbs, P.C. and general counsel to the Coalition.

The Coalition is an organization of interested companies and organizations dedicated to the development of federal/state policies which encourage the use of flexible, least-cost emissions control strategies under the Clean Air Act, particularly for the reduction of acid rain. Companies representing a variety of viewpoints drawn from the industrial user, electric utility, gas utility, equipment manufacturing, coal processor, engineering and consulting communities comprise the Clean Coal Coalition, Inc.

Summary

The Coalition urges the Congress to make revisions to remove the language in the Clean Air Act (Act) stating limits for sulfur dioxide emissions in terms of percentage reductions which effectively mandate post-combustion clean-up only and exclude more attractive, cost-beneficial pre-combustion clean-up alternatives. In this regard, the individual plant operator should be entitled under the Act to determine which control measures would be most effective and sensible on the basis of the site-specific characteristics of the plant. Flue gas desulfurization (FGD) or "scrubbing" is but one sulfur dioxide emission control option among several. Federal statutory requirements should not operate to dictate FGD as the only emission control option, but should preserve appropriate flexibility for development and use of other less costly emission control strategies. Comparable changes would also be necessitated in the Internal Revenue Code to correct its bias favoring post-combustion clean-up options for tax incentives while effectively excluding pre-combustion options for incentives offered by tax credits, rapid amortization and bond financing mechanisms in the Code.

Finally, we would focus Congressional attention on the fact that conventional coal cleaning is and should be recognized as the most cost-effective first step toward control of sulfur dioxide emissions. Effective cleaning operations can be profitable if energy now lost is recovered by burning the waste in sulfur-capturing fluid bed boilers. Early commercial introduction of economical coal/water fuels using deeply cleaned coal can also further increase the initial contribution of conventional coal cleaning. This approach can be coupled with selective use of natural gas to augument cleaned coal as a cost-effective, secondary step toward control of sulfur dioxide emissions.

Introduction

To a coal-burning utility plant, the most undesirable impurity in its fuel heretofore has not been sulfur but ash-forming mineral matter which causes fouling and slagging of its boiler tubes. These impurities degrade boiler performance due to reduced gas-to-tube heat transfer (hence increased heat rate to produce a given output), shorten intervals between de-slagging operations, and shorten tube life due to material attack (hence decreased boiler availability). Thus, even low sulfur western coal requires some cleaning to reduce ash content.

Cost of Reduced Coal Quality

It has been repeatedly observed that the availability of U.S. generating stations has been deteriorating over the years with the exploitation of lower-grade coal resources, as illustrated in Figure 1 in Attachment A. As noted by a prominent electric utility executive: "The drop is very substantial having taken into account the effect of the increasing production of low Btu Powder River Basin coal" (1).

The cost to the utility of impaired plant availability is also substantial. In the case of the American Electric Power (AEP) system cited as an example, to make up a 10 percent loss in availability of its 1,455 MW(e) coal-fired generating capacity due to coal-related outages would equate to a cost in excess of $1 billion (1980) for the financing and construction of new facilities.

Conversely, a more specific case of benefit from improvement in coal quality by conventional washing has been cited for the Muskingum River station on the AEP system (2). In this case, an investment of $18 million in upgrading the preparation facility at its Central Ohio Coal Company permitted the capacity of one of its Ohio Power Company units to be upgraded from 535 to 585 MW(e). This increase in capacity, if new, would have required a capital expenditure of $55 million and an annual owning cost of $13.8 million. It also increased the plant availability of 5 percent, yielding a benefit in pre-tax income of approximately $6 million per year to the electric utility system.

Regional Coal Characteristics

The characteristics of U.S. coal vary widely according to region, bed, coal seam and location within a seam. The composite characteristics of raw coals by region collected and aggregated by the U.S. Bureau of Mines (3) are presented in Table 2 of Attachment A. It may be noted that the energy content of the low-sulfur, predominantly sub-bituminous western coals is somewhat lower than that of the eastern bituminous coals even on a moisture-free basis. Because of the increased moisture content of the western coals, however, their actual heating value is significantly lower than those of the eastern coals.

The sulfur content of U.S. coals ranges from less than 1 to more than 7 percent. Organic sulfur, comprising 30 to 70 percent of the total sulfur content of most U.S. coals, is an integral part of the coal matrix and can be removed by chemical modification of the coal structure. Pyritic sulfur occurs in coal as discrete mineral particles. Pyrite is a heavy mineral with a specific gravity of 5.0; coal has a maximum specific gravity of only 1.7. To take advantage of this difference, the most widely using cleaning techniques for coal utilize density separation methods at specific gravities of 1.4 to 1.6. The degree of desulfurization obtained by crushing and specific gravity separation depends on the initial sulfur level in the raw coal, the ratio of pyritic-to-organic sulfur, the size distribution of pyrites, and the cleaning techniques used. In general, pyrite removal increases with increased crushing and lower specific gravity of separation.

The comparable characteristics of these coals following partial de-ashing in a routine preparation operation (crushing to 3/8-inch top size and heavy-media washing at 1.60 specific gravity) are presented in Table 3 of Attachment A. It may be noted that, in addition to ash, the mineral (pyritic) sulfur content of the coals is reduced, together producing a greater difference in energy content between the eastern and western coals, even on a dry basis. Since the moisture content of the lower-rank western coal is probably increased by washing somewhat more than that of the more highly developed eastern coals, the spread in actual heating value would be increased still further. This penalty in moisture content and heating value led the Bureau of Mines investigators to conclude that "...therefore, considering also the high transportation costs, extensive use of these (Western) coals in Eastern utility plants is doubtful" (4). */

While several common physical coal cleaning techniques are in commercial use, there is no universal approach to the design of coal cleaning plants, due to the substantial variability in the physical and chemical composition of coal between and within seams. A certain preparation method that is effective with a coal from one seam may be inappropriate with a coal from another seam to achieve a comparable level of cleaning. As particle size decreases, the chances for separating the coal and impurities increase, but processing costs increase as well.

With chemical cleaning, removal of organic sulfur from coal is possible. However, chemical processes require high temperature operations which also drive off the volatile components desired for stable combustion. The much higher cost of these developmental processes has heretofore discouraged their commercial consideration. It is more likely that microbial cleaning in aqueous media at room temperature will represent a commercialized coal cleaning option before 1990, well within the regulatory time frame of legislation currently under consideration.

Sulfur Emissions

So far nothing has been said about the potential of pre-combustion coal cleaning for reducing the emissions of sulfur dioxide released during combustion. Comparison of the data in Tables 2 and 3 of Attachment A suggests that it can be significant for bituminous coals in which a high fraction of the sulfur content is pyritic in nature, particularly for coals mined in northern Appalachia. This characteristic of the

---

*/ More extensive use of western coals in eastern utility plants is also rendered more doubtful because of the substantial transportation penalties being exacted by the railroads. The Interstate Commerce Commission (ICC) has recently concluded that this penalty is so substantial that western coals may not be considered as a viable economic alternative in eastern utility plant markets. Some coal production would be lost and others would be shifted from western to eastern coals if rail coal rates increase to or near the upper limit of allowable levels under proposed ICC guidelines. If enacted, the guidelines would permit railroads to increase their coal hauling rates by 15% per year above inflation.

northern Appalachian coals is particularly fortunate, since this region is immediately upwind of the region in which acid rain is most extensive, as shown in Figure 2 of Attachment A which is reproduced from the NAS/NRC report Acid Deposition (5).

The corresponding SO_2 emission levels in the same regions are shown in Figure 3 of Attachment A. It may be seen that, in addition to the states in the northern Appalachian region (Ohio, Pennsylvania, northern West Virginia), New York is also a significant SO_2 emitter. New York imports its coal, more than 80 percent of it from Pennsylvania, with an average heat value of 12,045 Btu/lb and average sulfur and ash contents of 1.9 and 14.3 weight percent, respectively (6). Because of their high SO_2 emissions and close proximity upwind of the New England states most affected by acid rain, these four states constitute a regional group offering the best opportunity for a concentrated, definitive experiment to determine the contribution of SO_2 emissions to acid precipitation, as was initially proposed by EPA Administrator Ruckelshaus last year.

Options for SO_2 Reduction

Four near-term options are immediately available as a means for effecting a sharp reduction in the level of SO_2 emissions for a given Btu output:

- Precombustion coal cleaning
- Select use of natural gas
- Switching to imported low-sulfur coal
- Flue gas desulfurization (scrubbing)

Of these options, the last two carry a cost penalty to the electric utilities involved and their ratepayers. The scrubber option is the most costly A study by the Pennsylvania Electric Company (7) has shown that "on average the capital cost of an FGD system is $230/KW, more than ten times the cost of low to mid level PCC (physical coal cleaning) systems at $20/KW. A FGD system costs, on average, 10 mills/KWH annually to own and operate (first year costs) compared to 3.0 mills/KWH for a PCC system." A third, unstated but large, cost of FGD systems is that they lower the overall availability of the powerplant. Contrary to the uninformed belief of some (8), scrubbers are not "mechanical devices...which filter out sulfur dioxide", but complex chemical plants connected directly downstream of the powerplant itself. Their well-known susceptibility to failure adversely affects overall system reliability and availability with the associated high cost penalty discussed earlier. Finally, scrubbers create substantial sludge disposal problems which have not been effectively studied, but have far- reaching implications under hazardous waste and resource recovery regulations.

Coal cleaning, on the other hand, is not a net cost, but an investment, leading to increased plant capacity and availability. If the AEP example cited earlier is any indicator, exercise of the coal-cleaning option can only improve the electric utility's "bottom line." Furthermore, it does not preclude additional control measures such as select use of natural gas for clean Btu augmentation or, as a last resort, scrubbing to the degree required.

Switching to imported, low-sulfur coal might be lower in direct cost to the electric utility despite its already premium price and vulnerability to transportation rate increases by the railroads. However, the cost of breaking long-term contracts with local coal producers would surely be substantial. Still higher would be the unquantifiable social cost of disemploying local coal miners. The true cost of dislocating a family cannot be measured in terms of lost wages alone, as has been disingenuously proposed, with compensation paid to "retrain and help relocate" the unemployed (8).

Considering the above range of options, it is clear that to mandate one or another is neither desirable nor necessary. Under freedom of choice, the individual plant manager will determine the least-cost combination specific to his own requirements, and will likely start with coal cleaning. It is hardly surprising that the Acid Rain Peer Review Panel for the White House Office of Science and Technology Policy singled out "intensifying coal washing" as one of the "first, 'least-cost' steps" to reduce sulfur emissions (9,10).

Limitations of Coal Cleaning

Why has the potential of physical coal cleaning (PCC) not previously received such high-level recognition? Physical methods for removing mineral impurities are effective on pyritic sulfur but do not affect the organic component, as may be concluded from comparing Tables 2 and 3 in Attachment A. Depending upon the coal, accordingly, conventional cleaning can remove from 25 to 50 percent of the total sulfur whereas a wet-sludge FGD system (when operating well) can remove up to 90 percent. This leads scrubber proponents to demand "Why not the best?", and the Clean Air Act to invoke superlative requirements for "Best Available Control Technology" (BACT) and "Lowest Achievable Emission Rate" (LAER) without explicitly evaluating the costs involved.

Judged from a benefit/cost perspective by the Environmental Protection Agency, however, coal cleaning has in fact received high marks. But, they were reported to a limited audience. First considered as an adjunct to improve the effectiveness of FGD systems (11), PCC later received the ultimate accolade: "Physical coal cleaning is the least-cost method of reducing sulfur emissions from the combustion of coal" (12). This led the Coalition to coin the term

"Least-Cost Compliance" for an investment strategy combining PCC with select use of natural gas (13).

Potential of Coal Cleaning

Studies for the Environmental Agency indicated that conventional washing of all the utility coal delivered in 1979 from eight states comprising four Bureau of Mines regions could have achieved an additional reduction in SO_2 emissions of 2.8 million tons above that actually realized that year by cleaning only part of the coal (14). Subsequently, this appraisal was revised downward to 2.4 million tons (15), but a more recent review adjusted the figure upward to about 2.5 million tons and extended the analysis to indicate that more intensive cleaning could double the number to 5 million tons annually (16).

These data are summarized in Table 4 of Attachment A together with the estimated cost of the two degrees of cleaning evaluated: conventional cleaning in which the coal is crushed to a top size of 1½-inches and separated from the mineral matter in a heavy medium (a suspension of fine magnetite in water) with a specific gravity of 1.60, and a more intensive cleaning involving crushing to 3/8-inch top size and separating at a lower specific gravity of 1.30.

Thus, the major additional SO_2 reduction is achievable in the northern Appalachian region whose coals are the most amenable to sulfur removal by physical means, as noted earlier. It may also be seen that the additional SO_2 reduction achievable by the more intensive cleaning is accompanied by a greatly increased cost of cleaning due to reduced "yield," or increased loss of energy value to the waste stream. This loss is illustrated graphically in Figure 4 of Attachment A, which indicates that the decreased recovery (yield) is due not so much to the increased degree of comminution (size reduction) as to an excessively low specific gravity of separation. A more nearly optimum separation might appear to be at 1.40 specific gravity, yielding an 80 percent Btu recovery and a sulfur reduction of 41 percent. For comparison with the data of Table 4, such a degree of coal cleaning would produce an additional SO_2 reduction of about 3.5 million tons.

The opportunities to improve sulfur and ash removal through coal cleaning vary widely and depend on upgrading existing coal cleaning facilities as well as installation of new plants. The limiting cost factor in physical coal cleaning is the loss of coal during the cleaning operation and the effective heating loss from increased moisture content. To achieve its full potential, EPRI and the utility industry have been supporting the development of improved coal cleaning technology plus characterization of steam coal cleanability and cost. These efforts are emphasizing finer (smaller particle size) coal cleaning and drying techniques to improve coal recovery and thus reduce cost.

Elimination of Loss to Waste

A loss of 20 percent of coal energy value to the waste stream would be economically unacceptable to a commercial coal-cleaning operation. This loss can be eliminated, however, if the waste is burned in an SO_2-capturing fluidized bed. Such an application could be designed to cogenerate high-temperature process heat for drying the washed coal, electric power to drive the mechanical operations at the preparation plant and for sale to the utility grid, and a benign solid combustion residue which need not be treated as a hazardous material but has useful commercial value (17). This subject is beyond the scope of the present testimony but has been elaborated elsewhere (18,19). The circulating fluid-bed combustion technology required is commercially proven and ready for immediate deployment.

Select Use of Natural Gas

The combined burning of coal with natural gas on a select use basis also appears to offer many potential economic, environmental and operational benefits to consumers, utilities, industrial users and the states. Under existing technology, dry coal can be used in a single combustor side-by-side with gas in another combustion process. Further, technological developments may offer prospects for more effective long-term combined combustion applications. Combined combustion of gas and coal-water fuels constitutes current technology.

With availability of technology and fuel supplies, the most significant impediment to broader deployment of select use is regulatory in nature. Regulatory approval of select use appears to be potentially achievable under both the Clean Air Act and the Powerplant and Industrial Fuel Use Act. But the regulatory review process is both formidable and uncertain, especially with respect to new facilities (Figure 1). Specific uncertainty currently exists with respect to whether select use is recognized by EPA as a control technology; whether a generic review process can be framed for such applications rather than a case-specific approach; and whether select use can be more effectively integrated into standards of BACT, RACT, LAER, and NSPS.

The number of states with high potential for deployment of select use of natural gas are fairly substantial and closely track the regional areas experiencing acid rain damage or symptoms (Figure 2). The costs of sulfur dioxide control by select use may vary from $50/ton of sulfur dioxide removed to over $1,000/ton.

The Gas Research Institute (GPI) recently published a study prepared by Environmental Research and Technology (21) which concluded that select use offered substantial benefits which current environmental regulation has failed to maximize.

These benefits include:

- reduced emissions of both SO_2 and NO_x
- less fly and/or bottom ash to collect and dispose of
- facilitated environmental permitting of conversion of existing oil-fired utility plants
- increased flexibility in siting new facilities in or near nonattainment areas
- decreased dependency upon imported oil supplies
- more fuel use options
- increased reliance on domestic energy resources
- decreased consumption of limestone and other sulfur-capture materials
- lower costs and land requirements for scrubber sludge disposal

Conclusion

The Coalition points out that conventional coal washing in an eight state region can alone achieve sulfur dioxide reductions of 2.5 million tons/year, while only slightly deeper coal cleaning techniques could elevate such reductions to almost 3.5 million tons/year with an outside ceiling of potential at 5 million tons/year. The reduction potential for select use of gas in 28 states could range from 1.5 million tons to 2.5 million tons/year depending upon the scope and breadth of application. By adding to this base the potential provided by more limited deployment of fuel switching or FGD technology, the range of emission reductions contemplated by several key pending bills is reached. However, full development of such least cost options would avoid the necessity for a massive national tax scheme, while forcing a review of our tax structure to remove disincentives to use pre-combustion clean-up approaches as outlined in Attachment B.

Therefore, the Coalition respectfully suggests that wider deployment of these currently available, cost-effective control techniques should not be effectively limited by the types of legislation currently pending before the Congress (H.R. 3251, H.R. 3400; S. 145, S. 769). Under the limitations of most of the proposed acid rain legislation, it is unlikely that this lower cost potential associated with coal cleaning or select use of gas will ever be realized.

In conclusion, the Coalition urges the Congress to make revisions in the Clean Air Act to remove the language stating limits for sulphur dioxide emissions in terms of percentage reductions which effectively mandate post-combustion clean-up only, and exclude more attractive, cost beneficial pre-combustion clean-up alternatives.

We thank you for the opportunity to appear before this Committee, and would be pleased to answer any questions you may have.

REFERENCES

1. G. Blackmore, "The Outlook for Steam Coal as Used by Electric Utilities," American Mining Congress, September 21-24, 1980, San Francisco, California.

2. G. Blackmore, "A Discussion on Enhanced Coal Technology - Coal's Market for the '80s," testimony before the U.S. Senate Subcommittee on Energy and Mineral Resources, Blacksburg, Virginia, August 9, 1983, Appendix A.

3. J. A. Cavallero, M. T. Johnson and A. W. Deurbrouck, Sulfur Reduction Potential of the Coal of the United States, U.S. Bureau of Mines Report of Investigation 8118, 1976.

4. Ibid, p.22.

5. Acid Deposition: Atmospheric Processes in Eastern North America, National Academy Press, Washington, D.C., 1983, p.14

6. Cost and Quality of Fuels for Electric Utility Plants, 1981 Annual, U.S. Department of Energy, DOE/EIA-0191(81), p.72.

7. A. A. Slovik, "Evaluation and Implementation of Coal Cleaning in an Integrated Environmental Control System," Second ASME/EPRI/APCA Symposium on Integrated Environmental Controls for Coal-Fired Power Plants, February 15-18, 1983, Denver, Colorado.

8. P. R. Portney, "High-Price Cure for Acid Rain," The Washington Post, August 12, 1983.

9. General Comments on Acid Rain, A Summary by the Acid Rain Peer Review Panel for the Office of Science and Technology Policy, Executive Office of the President, June 27, 1983.

10. W. C. Ackerman, testimony before a Joint Hearing on Acid Rain by the Subcommittees on Energy Development and Applications and on Natural Resources, Agricultural Research and Environment of the House Committee on Science and Technology, September 13, 1983.

11. E. C. Holt, Jr. and A. W. Deurbrouck, Coal Cleaning with Scrubbing for Sulfur Control: An Engineering/Economic Summary, EPA-600/9-77-017, August 1977.

12. E. H. Hall, A. W. Lemmon, Jr., G. L. Robinson, F. K. Goodman, J. H. McCreery, R. E. Thomas and P. A. Smith, Use of Coal Cleaning for Compliance with SO_2 Emission Regulations, EPA-600/57-81-146, October 1981.

13. L. Green, Jr., "Least-Cost Compliance with Air Quality Standards," ASME Paper No. 82-JPGC-APC-1, October 1982. Later published as "Clean Air and Coal-Water Slurry," Mechanical Engineering, Vol. 104, No. 11, November 1982, pp.34-39.

14. R. A. Chapman and M. A. Wells, Coal Resources and Sulphur Emission Regulations: A Summary of Eight Eastern and Midwestern States, EPA-600/7-81-086, May 1981.

15. J. B. Strauss, "Coal-Preparation for Sulfur Dioxide Control: The Technology," statement before the Subcommittee on Health and Environment, House Committee on Energy and Commerce, October 20, 1981.

16. J. B. Strauss, unpublished communication, September 1, 1983.

17. L. Green, Jr. "Cogeneration the Key to Effective Coal Cleaning," Cogeneration World, Vol. 2, No. 1, January/February 1983, pp.23-24.

18. L. Green Jr., "Value Derivable from Coal Waste by Entrained-Flow Combustion," Proc. Fifth Annual Symposium on Industrial Coal Utilization, June 6-7, 1983, Pittsburgh, Pennsylvania, pp.138-151.

19. L. Green, Jr., "Drying Cleaned Coal by Burning Coal Waste," Third International Conference on Cogeneration, October 13-14, 1983, Houston, Texas.

20. Evaluating the FBC Option, Government Institutes, Inc., Rockville, Maryland (October, 1983)

21. Evaluation of the Environmental and Other Benefits of the Select Use of Natural Gas, Environmental Research & Technology , Inc., Washington, D C. (November, 1983)

b.

Clean Coal Coalition, Inc.
1828 L Street, N.W.
Washington, D.C. 20036
Phone (202) 887-5537

January 13, 1984

FEDERAL TAX ISSUES AFFECT DEPLOYMENT OF COAL CLEANING TECHNOLOGY OPTIONS©

Pre-combustion coal cleaning and preparation techniques are in the forefront of developing alternative energy and environmental technologies. Unfortunately, federal income tax law, and particularly Federal income tax incentive programs, have generally not kept pace with technology developments in this area. This analysis attempts to summarize major Federal income tax incentive programs as they pertain to coal cleaning technologies, and offer recommendations on approaches under which incentives might be provided for such technologies in the future.

PRESENT TAX PROGRAMS

Rapid Amortization

The only incentive for coal cleaning equipment which is presently available in the Internal Revenue Code (Code) is rapid amortization of the costs of the cleaning equipment. However, while this once could have been a significant incentive, the inherent limitations on the scope of this provision, coupled with subsequent developments before the Congress, have significantly reduced its usefulness to the taxpayer.

Rapid amortization allows a taxpayer to recover the cost of qualifying equipment ratably over a 5-year period. When it was enacted, this approach provided a significant incentive because it allowed cost recovery over a much shorter time period than was available under depreciation practices available at that time. However, with the enactment of the Accelerated Cost Recovery System (ACRS) in 1981, most business property can be depreciated over a 5 year period, and at accelerated rates. Accordingly, rapid amortization is now only a meaningful incentive for public utility property, for which ACRS provided a 10 or 15-year recovery period.

Rapid amortization is available for pollution control equipment, including equipment which prevents the creation of pollution, which is installed pursuant to a state pollution control program, and which satisfies certain federal requirements. There are several significant limitations on the scope of this provision:

1) The equipment must be installed in connection with a facility which was in operation on January 1, 1976.

2) The equipment must not increase the output of the facility, alter the nature of the production process at the facility, or perform a function in addition to controlling pollution.

3) The equipment must not have a useful life in excess of 15 years. If it does, the portion of the cost subject to amortization may have to be reduced.

Unlike most items of amortized property, pollution control equipment is eligible for the full investment credit. */ However, the election of rapid amortization may increase the taxpayer's minimum or alternative minimum tax liability exposure. Finally, for certain corporations, rapid amortization may only be claimed with respect to 85% of the amortizable basis of the property.

Industrial Development Bonds

Tax-exempt financing through the use of tax-free industrial development bonds has became a popular source of debt financing for a variety of private sector projects. Tax-exempt financing can generally be used only for investments in one of the specific categories of "exempt facilities" listed in the Code, such as air pollution control facilities. Unfortunately, the IRS has consistently taken the position that, for purposes of Section 103, pollution control equipment does not include equipment which removes potential pollutants from a fuel or feedstock. Instead, the property must be used to remove, alter, or dispose of a pollutant once it has been produced. See Proposed Reg. § 1.103-8(g)(2)(ii). Accordingly, pre-combustion coal cleaning equipment would not be eligible for IDB financing because of this restriction.

Energy Tax Credits

The Energy Tax Act of 1978 provided an energy tax credit for certain items of energy property, including "alternative energy property." The alternative energy property category included several classes of property which utilize coal, including coal-fired boilers and other types of coal-fired burners. It also includes pollution control equipment and on-site preparation equipment. Because pollution control equipment is defined by reference to the IDB provision, rather than the amortization provision, coal cleaning equipment would not be included in that category. Nor would equipment of a coal producer and intermediate coal processor have qualified for the energy tax credit. However, coal cleaning equipment located on-site could have qualified as handling and preparatory equipment.

Unfortunately, the energy tax credit for most items of alternative energy property, including coal usage property, expired at the end of 1982. Accordingly, these incentives are only available for equipment installed in connection with long-term projects which satisfied the "affirmative commitments" requirements at the end of 1982.

---

*/ The credit is reduced by 50 percent if the property is financed by Industrial Development Bonds (IDBs). However, as discussed herein, pre-combustion coal cleaning equipment is not eligible for IDB financing. Accordingly, this limitation is not directly relevant.

OPTIONS FOR LEGISLATIVE ACTION

Any legislative action must be undertaken with an understanding of the present political climate. It is appropriate to evaluate alternative tax incentive programs to be pursued in the future as part of an acid rain control strategy program. The Clean Coal Coalition recommends that such tax incentive programs must focus on other available technology options such as coal cleaning and processing, select use of natural gas, and fluidized bed boilers. Any legislative action in this regard should specifically provide incentives for broader deployment of these coal pollution control technologies.

Energy Tax Credit

The energy tax credit provisions which expired at the end of 1982 could be reinstated. In addition, the definition of pollution control equipment for purposes of the tax credit should be revised to track the definition in the rapid amortization provision, rather than the IDB provision. In the alternative, or in addition, a specific tax credit targeted to particular coal cleaning technologies could be enacted. In either case, it would be helpful to extend the credit to public utility property as well as to coal producers and intermediate coal processors.

Industrial Development Bonds

The IDB definition of pollution control equipment could be revised to follow the rapid amortization definition. In the alternative, a special category of exemption could be provided for particular coal cleaning technologies.

Cost Recovery

Utility-owned coal cleaning equipment could be taken out of the ten and fifteen year categories and could be treated as five year property. (There is precedent for such specialized treatment since under current law, certain replacement coal-fired boilers and burners are treated as ten year rather than fifteen year property.)

Other Opportunities

In addition to approaches which parallel existing incentive programs, it is important to attempt to identify new opportunities to encourage coal cleaning activities. For example, in connection with recent proposals to enact an energy consumption tax, an effort could be made to obtain an exemption for coal used in qualifying facilities.

Finally, non-tax alternatives might be considered to satisfy the special financing requirements of public utilities which are not investor-owned in recognition of their unique requirements and operational attributes.

1.

REGULATORY IMPACTS ON THE POTENTIAL FOR SELECT GAS USE

Market	Impact of Clean Air Act	Impact of Fuel Use Act	Combined Impact
Existing Electric Powerplant	●	●	●
Existing Large Boiler	●	●	●
Existing Small Boiler	●	●	●
Existing Large Non-Boiler	●	●	●
Existing Small Non-Boiler	●	●	●
New Small Boiler	◒	●	◒
New Small Non-Boiler	△	●	△
New Large Non-Boiler	▲	●	▲
New Large Boiler	▲	△	▲
New Electric Powerplant	▲	△	▲

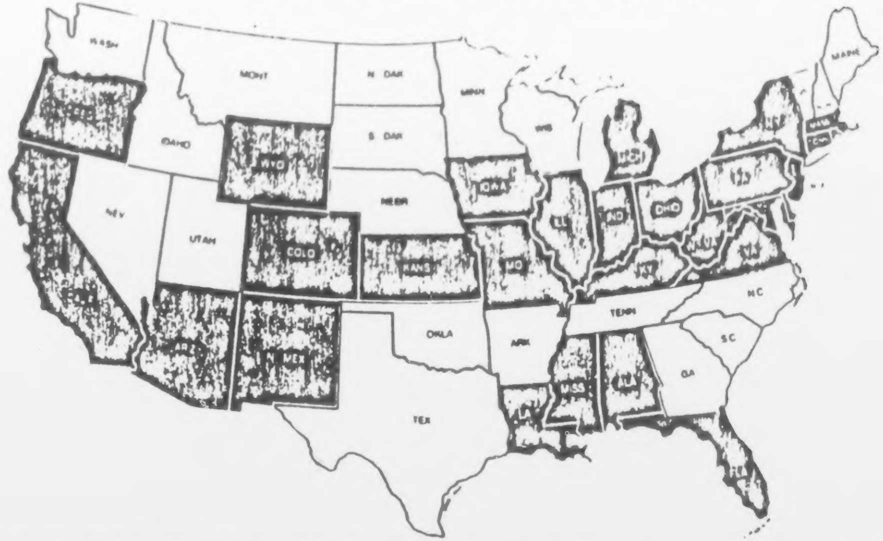
Legend

● Not a Constraint
◒ Moderate Constraint, Sizable Market
△ Moderate Constraint, Limited Market
▲ Severe Constraint

Note: Judgment Based on Current Interpretation of Legislation

2.

STATES WITH HIGH POTENTIAL FOR SELECT GAS USE



Note: States shaded have relatively strict sulfur emission limits (oil <1 #/MMBtu; coal < 1.2 #/MMBtu) and also have either a heavy dependence on oil for electrical generation (> 10%), or have powerplants which are not currently meeting their sulfur emission limit.

TESTIMONY OF WILLIAM G. KARIS, VICE PRESIDENT - CORPORATE PLANNING

ON BEHALF OF

CONSOLIDATION COAL COMPANY
CONSOL PLAZA
1800 WASHINGTON ROAD
PITTSBURGH, PENNSYLVANIA 15241

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
OF THE U.S. SENATE

CONCERNING

THE SEC. 120 INTERSTATE TRANSPORT AND ACID PRECURSOR REDUCTION
PROVISIONS OF S. 768

WASHINGTON D.C.
FEBRUARY 10, 1984

Mr. Chairman, I am William G. Karis, Vice President - Corporate Planning for Consolidation Coal Company. I have attached a summary of company data (Attachment A).

It is appropriate that the Committee has decided to once again hold hearings on acid rain because much has changed since the emission control concepts in S. 768 were first introduced several years ago.

This particular legislation is based upon two premises which have been proven to have little scientific support. First, that acid rain is a recent phenomenon of man-made origin causing extensive ecological damage over large areas of eastern North America at an accelerating rate. And second, that the principal cause of acid rain is emissions of sulfur dioxide from powerplants in the midwest which ultimately are transformed into acidic materials and are deposited hundreds of miles away.

In support of our position, Mr. Chairman, I offer several items for the record. First is a list of recent scientific papers which show that the charge of widespread acid deposition damage in the United States cannot be substantiated by the evidence (Attachment B). Data going back as far as 1910 have recently been assembled which suggest that sulfur deposition throughout the eastern U.S. has remained more or less constant over the last seventy years. Higher quality data gathered since the 1960's show that dramatic reductions in bulk sulfur deposition have occurred during the last twenty years in the northeast. Other studies show that the acidification of lakes and streams in the northeast is an extremely slow process and may be primarily natural in occurrence. Last week, this Committee heard EPA Administrator Ruckleshaus mention the possibility that all of the damage to lakes that will happen has already occurred. This hypothesis is consistent with the finding of no changes in lake water chemistry in several intensely monitored lakes over the last five years.

Second, I offer a study by Environmental Research and Technology, Inc. (Attachment C). The principal author of this study, Dr. George Hidy, was also one of the authors of the most recent National Academy of Sciences review of acid rain. This study examines historic trends in SO_2 and NO_x emissions in the eastern United States and trends in the deposition of acidifying substances. Among other findings, it reveals that only in the northeast (EPA regions I and II) do sulfur emission and sulfate deposition trends track each other closely. This suggests that should protection of the northeast prove necessary, far more control of locally generated northeastern emissions than would occur under S. 768 will be required. The National Academy of Sciences (NAS) Review stated that SO_2 emissions were limited to a relatively small zone of influence - on the order of 300 to 600 kilometers. S. 768 focuses too strongly on long range transport.

As this Committee is well aware, S. 768 employs an emission reduction allocation formula which includes only those sources in a state emitting at a rate exceeding 1.5 lbs. SO_2/MMBTU. If further SO_2 emission restrictions are a matter of critical concern, as this bill suggests, then it is not scientifically justifiable to allocate emissions reductions only from sources emitting greater than an arbitrary rate. SO_2 is SO_2 regardless of emission rate.

Controlling SO_2 on the basis of emission rates would produce a kind of environmental gerrymandering which would subject the midwest and the south to large emission reductions while virtually ignoring the considerable emissions generated by industrial and non-coal sources in the northeast.

To underscore the inequities which would be created by the allocation system in S. 768, I submit a calculation based on published emissions data (Attachment D). Although the tons of pollutants emitted per state may be less in the northeast, the density of emissions (tons of acid precursor pollution per square mile) is not. Emission densities are a better measure of general air quality and deposition than are absolute emission rates. Emission densities in the northeast are comparable to those in the midwest, further demonstrating the dominant role northeastern emissions may play in northeastern deposition.

In sum, Mr. Chairman, these data suggest that the immense emission reductions contemplated by this bill are not warranted either by identified ecological damage or by current scientific understanding of source/receptor relationships. The particular method of allocating reductions in S. 768 is simply not supportable from a scientific viewpoint.

Finally, Mr. Chairman, I would offer for the Committee's consideration two other scientific studies. The first is a study by Systems Applications Inc. which will be printed next week. Copies will be submitted to the record shortly thereafter. This study advances the state of scientific understanding of atmospheric chemistry and reopens the question of nonlinearity. It demonstrates that, in sharp contrast to the NAS Review, the atmosphere may behave in a strongly non-linear fashion. That is, large reductions in SO_2 emissions might result in much smaller reductions in sulfate deposition.

The other is a study performed by Du Pont and Du Pont's Haskell Laboratories for Consol which lays to rest the charge that excess deaths are occurring because of sulfate concentrations in the atmosphere (Attachment E). The allegation is not supported by the evidence.

It is clear to us, Mr. Chairman, that despite a growing body of scientific evidence which suggests that immediate action is not required, many people, including some on this Committee, are determined to press ahead with this ill-advised control program. Therefore, I would invite the Committee's attention to other compelling reasons why Congress should not adopt measures such as S. 768.

This Committee has heard from witnesses who have discussed the economic impacts of S. 768 or its predecessor bills. I will not challenge them today although several of the studies presented are not consistent with similar economic analyses which we have done. Most of these analyses have focused primarily upon the economic consequences of emissions reductions to utilities and their rate payers and upon the direct (and to some extent indirect) employment effects. Adequate attention has not been given to the indirect impact on the coal industry and local communities. We would agree with these analyses to this extent: the annual costs to utilities and their customers will be in the billions of dollars, and the employment impacts in high sulfur coal producing areas could lead to the loss of over 100,000 jobs.

We believe that these analyses have only scratched the surface in analyzing the costs of the bill currently under consideration. To illustrate this point I would like to offer some rough estimates of several costs that have not been considered. For example, the costs of closing existing high sulfur coal mines as a result of passing S. 768 have been totally ignored. We estimate that it costs approximately $5 per annual ton of capacity to physically close a mine. This includes the costs of sealing the mine, removing surface structures, and reclaiming the surface areas disturbed during the mining process. In addition, there are several major on-going liabilities including pensions, federal and state black lung payments and workers' compensation that would have to be funded from alternative sources after the mine is closed. For a one million ton per year mine, the present value of these liabilities would total approximately $30 million. Thus, the costs for each million tons of high sulfur production capacity that is prematurely lost because of S. 768 would be approximately $35 million. These values are based on Consol's experience factors and may be different for other companies, but I believe the order of magnitude is correct.

Consider also the loss in capital investment and recoverable reserves of prematurely closing existing high sulfur coal mines. The value of this loss can range from $50-$70 per annual ton of production capacity based on the cost of replacing this production. Including the on-going liabilities previously discussed, the total loss of prematurely closing 1.0 million tons of high sulfur production capacity would be approximately $100 million. If the loss in annual high sulfur production capacity were as much as 100 million tons, this potential impact on the coal industry would be in the area of $10 billion.

In addition to these costs, S. 768 would result in substantial labor training, relocation and unemployment costs due to the loss of jobs in high sulfur coal producing areas. A loss of 100 million tons of high sulfur coal production could result in 100,000 less jobs in high sulfur coal regions. If only half these workers were to be relocated and retrained at a cost of $30,000 per worker, this cost to society would be $1.5 billion.

Regional shifts in coal production and employment would also require substantial investment in public facilities and infrastructure. A very rough estimate of the public infrastructure requirements would be approximately $25,000 per person. Assuming the creation of 100,000 new jobs in low sulfur coal producing areas, this impact would be about $2.5 billion.

Finally, S. 768 would have a significant impact on the U.S. balance of payments. Price levels for low sulfur coal would rise sharply under this bill which would make U.S. exports less competitive in world markets. The loss of just 10% of U.S. steam coal exports in the mid-1990's would cost the U.S. economy between $300 and $500 million per year. This in turn would have a multiplier effect on the total U.S. economy which could be as much as $1.0 billion. The shift to low sulfur coal that would occur under S. 768 would also lead to a substantial increase in the transportation requirements of the coal industry. If this increase were to amount to 100 billion ton-miles per year, it would increase diesel fuel or crude oil imports by as much as $500 million annually.

My point in all of this, Mr. Chairman, is not to lay before the Committee an exact accounting of the indirect costs of S. 768, but rather to suggest that we have only just begun to recognize the economic consequences of such legislation. The fact is that the effects of S. 768 go far beyond the scope of any of the cost studies conducted thus far. Indeed, the economic consequences of cost increases in the energy sector are so pervasive that it is doubtful that any model, no matter how complex, can predict the full impact on society. Experience with the oil price shocks of the 1970's are ample proof of this point.

Consol has retained Arthur D. Little to undertake a study examining these societal impacts in greater detail. This study should be completed within the next two months. I urge the Committee to refrain from taking any action until we have had a chance to submit this study for your review.

Mr. Chairman, the scientific basis for S. 768 is so poor and the economic consequences so large that we cannot support enactment of this bill. We urge the Committee to withhold final judgement on this issue until the research programs Congress has already put in place have been completed. And we urge all in Congress to support increases in funding for research not only into the causes and effects of acid deposition, but also for research into new technologies to control emissions created by our use of energy. We support S. 454 and S. 1925 which would implement this suggestion.

Consolidation Coal Company has been the industry leader in developing new technologies to burn coal in a more economic and environmentally acceptable manner. I have included a pamphlet describing our research facilities at Library, Pa. and some of the activities in which we are engaged. I did, however, want to note specifically our work with LIMB -- Limestone Injection Multi-stage Burners. I know that the Committee is aware of this technology so I will not spend time describing it. Rather, I wanted to report on work that our coal research division is about to undertake. To expedite the commercialization of LIMB, we are planning a demonstration of the technology this summer in a large industrial boiler owned by our parent company, Du Pont. Our goal is to demonstrate the technical viability of the process on an industrial scale. This demonstration is a good example of how we as a company are utilizing our resources to take a large step toward the commercialization of cost effective SO_2 control technologies.

We hope that Congress will not require untimely emission reductions which could short-circuit the opportunity to develop technologies such as LIMB.

Thank you, Mr. Chairman, that concludes my remarks.

Attachment A

CONSOLIDATION COAL COMPANY
Fact Sheet

Consol, a leading coal producer in America, employs more than 10,700 people at 30 surface and underground mines in nine states, Canada and Australia.

In 1983 Consol produced an estimated 42.5 million tons of coal and recorded its safest year in history. Annually, Consol ranks among the safest coal producers in America. The 120-year-old company is a major supplier of coal to the electric utility and steel industries, general industry and for export overseas.

Attachment B

"Analysis of Trends in Historical Acid Precursor Emissions and Their Airborne and Precipitation Products" Hidy, Henry, Hansen, Ganesan, and Collins. Environmental Research and Technology, Westlake Village, CA. November, 1983.

"Sulfate Air Pollution Health Effects - A Critical Review of Office of Technology Assessment Draft Report," Kittleman, Hess, Snee, Sprout, Kerch, and Hamilton, Du Pont Company. June, 1983.

"Final Report Modeling Studies of Sulfate and Nitrate Chemistry - The Effects of Changes in Sulfur Dioxide, Nitrogen Oxide, and Reactive Hydrocarbon Levels; "Seigneur, Saxena, Dudik, Whitten and Roth, Systems Applications, Inc., San Rafael, CA. December, 1983.

"Temporal Variations in Acid Precipitation Over New York State - What the 1965-1979 USGS Data Reveal." Bilonick and Nichols. Atmospheric Environment 17:6. 1983.

"Risk Qualified Maps of Hydrogen Ion Concentration For the New York State Area For 1966-1978." Bilonick. Atmospheric Environment 17:12. 1983.

"An Analysis of Potential Indirect Health Effects of Acid Rain Through Drinking Water" A.D. Little, Inc. June, 1983.

"Factors Controlling the Acidity of Natural Rainwater." Charlson and Rohde. Nature 295. 1982.

"Acid Rain: an assessment based on acid-base considerations." Sequeira. Journal of the Air Pollution Control Association 32. 1982.

"Evidence for Acid-Precipitation-Induced Trends in Stream Chemistry at Hydrologic Bench Mark Stations." Smith and Alexander. Geologic Survey Circular 910. Washington, DC: GPO, 1983.

"Acquisition and Analysis of Long Term pH Data from Lakes." Bailey, Javitz, and Walter. EPRI 1822. Palo Alto, CA. 1984.

"Another Interpretation of the pH Trend in the United States." Stensland and Semonin. Bull. Amer. Meteorol. Soc. 63. 1983.

"Total Alkalinity of Surface Waters -- A National Map." Omernik and Powers. U.S. EPA Corvallis, OR. 1983.

"Acidification of Aquatic Systems: A Critique of Chemical Approaches." Kramer and Tessier. Environmental Science and Technology 16:11. 1982.

"Acid Generation in the Troposphere by Gas Phase Chemistry." Calvert and Stockwell. Env. Sci and Technol 17:9. 1983.

"Alternative Explanations For Aquatic Ecosystems Effects Attributed to Acidic Deposition." Retzsch, Everett, Duhaime, and Nothwanger. Everett and Associates. Rockville, MD. March, 1982.

"An Atmospheric Sulfur Budget for Eastern North America." Galloway and Whelpdale. Atmospheric Environment 14:4. 1980.

"Acid Deposition - Precursor Emission Relationship in the Northeastern USA: The Effectiveness of Regional Emission Reduction." Golomb. Atmospheric Environment 17:9. 1983.

"Comment on Acid Precipitation in Historical Perspective" and "Effects of Acid Precipitation." Richter. Environ. Sci Technol 17:9. 1983.

"Eine Arbeitshypothese uber die Fichtener krankunq in den Hochlagen des Bayerischen Waldes." Rehfeuss. Symposium Saurer Regen - Waldschaden Julich. January, 1983.

"Analysis of Claim That Acid Rain is Killing Red Spruce Trees on Camels Hump, Vermont." HaNsen. Environmental Research and Technology, Inc. Westlake Village, CA. August, 1983.

"Thoughts on Acidic Precipitation and the Rate of Ecological Damage." Perhac. EPRI Palo Alto, CA. 1983.

"Acid Rain on Acid Soil: A New Perspective." Krug and Frink. Science 221. August, 1983.

"Perspectives on Acid Rain." Chester. W. J. Pope Memorial Lecture. Leatherhead, Surrey U.K. April, 1983.

"Acid Precipitation Research Needs Conference." Proceedings. SUNY-Syracuse, NY. March, 1982.

"Acid Deposition and Forest Decline." Johnson and Siccama. Environ. Sci. Technol. 17:7. 1983.

"Comments on OSTP Interim Acid Rain Peer Review Panel Report." Lefohn. A.S.L. & Associates. Helena, Mt. August, 1983.

"Examination of the Basis for Trend Interpretation of Historical Rain Chemistry in the Eastern United States." Hansen and Hidy. Environmental Research and Technology, Inc. Westlake Village, CA. November, 1980.

"Temporal Trends in the Acidity of Precipitation and Surface Waters of New York." Peters, Schroeder, and Troutman. Geological Survey Water Paper 2188. Washington, DC. 1982.

"Acid Precipitation and Ionic Movements in Adirondack Forest Soils." Mollitor and Raynal. Soil Sci. Soc. Am. 46. 1982.

"Effect of Simulated Acid Precipitation on Algal Fixation of Nitrogen and Carbon Dioxide in Forest Soils." Chang and Alexander. Environ. Sci. Technol. 17. 1983.

"Seasonal and Episodic Trends in Sulfate Concentrations (1963-1978) in the Eastern United States." Altshuller. Environ. Sci. and Technol. 14. 1980.

"Variation in Chemical Wet Deposition with Meteorological Conditions." Raynor and Hayes. Atmospheric Environment 16:7. 1982.

"The Atmospheric Effects of El Chichon." Rampino and Self. Sci. American. 1984.

"Wet Deposition Variability as Observed by MAP3S." Wilson, Mohnen, and Kadlecek. Atmospheric Environment 16. 1982.

ATTACHMENT C

Document P-B538-R
November 1983

Prepared for
The Peabody Coal Company
St. Louis, Missouri &
The Consolidation Coal Company
Pittsburg, Pennsylvania

Analysis of trends in historical acid precursor emissions and their airborne and precipitation products

Prepared by
G.M. Hidy
R.C. Henry
D.A. Hansen
K. Ganesan
J. Collins

2625 Townsgate Road
Westlake Village, CA 91361

ERT
ENVIRONMENTAL RESEARCH & TECHNOLOGY, INC
ATLANTA · CHICAGO · CONCORD MA · FORT COLLINS CO
HOUSTON · LOS ANGELES · PITTSBURGH · WASHINGTON DC

The following has been excerpted from the above named report.

EXECUTIVE SUMMARY

This study has compiled and examined historical data from the eastern United States on emissions of SO_2 and NO_x, ambient concentrations of sulfur and nitrogen oxides (both in gas form and as particulate sulfate and nitrate), and deposition of acidifying substances, principally sulfate and nitrate, including their concentrations in precipitation. It has compared the data on emission trends, segregated on a subregional basis, with the data on trends in ambient concentrations and deposition in order to determine the nature of the relationships, if any, between them. The recent report from the National Academy of Sciences (NAS 1983) addressed these issues, finding "no evidence for a strong nonlinearity in the relationships between long-term average emissions and deposition" (p. 7). However, that report relied on deposition data from only a single site (Hubbard Brook, NH), did not look closely at differences in subregional emission trends, and did not consider weighting of emission contributions to deposition by meteorological factors such as air mass trajectories or precipitation levels. In the present study, we have attempted to supplement and elaborate on the NAS study by (among other things) examining deposition data from additional sites, looking closely at emission trends on a subregional basis, and weighting emissions to account for meteorological factors. The results of this study shed further light on, and qualify the conclusions of the NAS study.

The principal findings of the present study are as follows:

- Early data on sulfur dioxide emission patterns may be inferred using coal consumption as a rough index for emissions. Coal use figures show an increase from 1900 to 1920, a decrease during the Depression, an increase to a maximum in the late 1940s, a decline thereafter, and another increase in some states after 1960.
- From 1950 through 1980, direct estimates of emissions are available. They show large increases in both SO_2 and NO_x emissions between 1950 and 1965. Between 1965 and 1978, SO_2 emissions continued to increase in the Southeast, but declined

in the Northeast (by about 38-40%), the Mid-Atlantic (by about 11%), and the Midwest (by about 18%). NO_x emissions after 1965 continued to increase in the mid-Atlantic states, the Midwest, and the Southeast; in the Northeast, they continued to increase only until about 1970 and then leveled off or slightly declined.

- Essentially no data exist on rural ambient SO_2 and NO_x gas concentrations prior to 1976. Data reported for a year between 1977 and 1978 show a broad region of elevated SO_2 levels over the upper Ohio River Valley and western Pennsylvania, but a sharp decrease in SO_2 levels to the northeast, and very low levels in the Adirondacks and upper New England. Equivalent results for NO_x are not available. Data from a privately owned network since 1976 indicate that SO_2 concentrations generally increased over the Ohio River Valley until the late 1970s and have steadily declined since then.
- Data on ambient particulate sulfate concentrations exist for a few rural sites in the eastern U.S. since 1962. They are variable in quality. In general, the data from sites in the Northeast and mid-Atlantic states suggest a peak in ambient sulfate levels in the early to mid-1970s, followed by a decline. This trend in the Northeast does not reflect the generally steady decline in SO_2 emissions in the Northeast and the Midwest since about 1965, while the sulfate trend in the mid-Atlantic states is closer to the SO_2 emission trend in that area.
- Data on particulate nitrate, as represented by nitrate collected on glass fiber filters since 1962, are unreliable for quantitative long-term analysis. However, they suggest a steady increase in filter-collected nitrate through 1980.
- Observations of sulfur deposition and sulfate concentrations in precipitation in the eastern U.S. exist for several locations for periods of time through the 1950s. The early data represent bulk deposition, capturing both wet and dry deposits, the latter with great uncertainty, and may reflect influences of local sources. Data taken after 1950, particularly wet

deposition reported by Junge and Werby (1958), are more reliable and more representative of regional conditions. The available data indicate that potentially ecologically susceptible areas have been exposed to elevated sulfur deposition levels for more than 30 years, but they also indicate (in combination with recent data) that there has been no systematic increase in sulfur deposition or sulfate in precipitation over that period. Indeed, the data indicate a general decline in sulfur deposition in the Northeast and Midwest and little or no change in the Southeast.

- A few stations have continuous records of sulfur deposition and concentrations of sulfate in precipitation since 1965. These are the Hubbard Brook, NH, station and the stations operated by the USGS in New York State and (one) in northern Pennsylvania. The Hubbard Brook data are believed to be reliable; it appears from a comparison of the USGS sulfate data for two sites in upper New York (Hinckley and Mays Point) with good quality data from nearby MAP3S sites, that the USGS data, particularly for those two sites, also provides a self-consistent, reliable long-term record of sulfate deposition.
- Intersite analysis of the USGS stations showed substantial differences in precipitation sulfate behavior. Hinckley, Mays Point and Canton, NY were intercorrelated, but a large part of sulfate variability contained a regionally nonhomogeneous component. Sulfate at Salamanca, NY and Athens, PA, were uncorrelated with each other and the other stations. These results show that reliance on a single station record is not necessarily adequate to determine regional deposition behavior or trends.
- Linear regression analysis of the Hubbard Brook sulfate data indicates an approximately 30% decrease in precipitation sulfate concentrations from 1964/65 to 1979/80. Time-series analysis of the USGS data from Hinckley and Mays Point indicates essentially the same decrease in precipitation sulfate levels at those sites over the same period. Less detailed analysis (by box plots) also indicates a downward

trend in precipitation sulfate concentrations at a third USGS site in northern New York (Canton). No trend was found in data at the two USGS sites closer to high SO_2 source areas -- Salamanca in western New York and Athens in northcentral Pennsylvania.

- Data for bulk nitrate deposition or precipitation nitrate concentrations prior to the 1950s are scarce. After that time, observations have been reported intermittently at several locations. Continuous records since 1965 exist for the same sites as for sulfate. Apart from the Hubbard Brook data, these nitrate data appear to be less reliable than the sulfate data. The nitrate observations, particularly from Hubbard Brook, suggest a gradual increase in precipitation nitrate levels through the early 1970s, followed by a leveling off or a slight decline.
- Commensurate records of hydrogen ion measurements in deposition are the least reliable for trend analysis. They show no significant trend between 1965 and 1980 at any of the stations and are poorly correlated with sulfate or nitrate levels.
- Comparison of subregional SO_2 emission trends since 1965 with the precipitation sulfate trends since that date indicates that the decline in precipitation sulfate concentrations at Hubbard Brook, Hinckley, and Mays Point is consistent with the SO_2 emission trends in the Northeast, but is less consistent with the emission trends in the mid-Atlantic and Midwest, and contrary to the emission trend in the Southeast. Comparison of the precipitation nitrate data from Hubbard Brook with NO_x emission trends for the same period yields roughly comparable conclusions. These findings suggest that wet deposition at northeastern sites far from large source areas is influenced principally by emissions in the Northeast itself, rather than by emissions in other source regions. By contrast, the data from sites closer to large sources areas (Salamanca and Athens) show no discernible trend in precipitation sulfate and thus do not appear to reflect the SO_2 emission trends in either nearby or distant regions.

- If emissions segregated by state or province are weighted to account for prevailing winds and/or dispersion, the results point to the greater importance of sources in nearby states and provinces for wet sulfur deposition in the Northeast. The changes in sulfate deposition estimated from emissions with the meteorological weighting are similar to those indicated by subregional emissions alone: The estimated deposition changes at remote sites in the Northeast follow closely the SO_2 emission trends in the Northeast and are consistent with the observed trends in volume weighted sulfate concentrations at Hubbard Brook, Mays Pt. and Hinckley. The smaller estimated deposition changes at sites closer to the Midwest follow more closely the SO_2 emission trend in that region, but are not necessarily verified by the observations of precipitation sulfate at Salamanca and Athens. The reason for the latter inconsistencies is not known, but may be related to the quality of the USGS data, or to unidentified atmospheric factors or local emissions. The wet nitrate deposition changes estimated with the meteorological weighting follow the general trend in NO_x emissions and are similar to the observed changes in precipitation nitrate.

Taken in their entirety, these findings present a complex and inconsistent picture of trends since the turn of the century, particularly since the mid-1960s. They do not confirm or negate the hypothesis of a linearly proportional relationship between SO_2 and NO_x emissions and precipitation sulfate and nitrate concentrations in the Northeast. They do suggest, however, the importance of source-receptor distance -- i.e., the greater relative importance of closer sources -- and of prevailing winds in the exposure to deposition, although these factors cannot be reliably quantified at this time. They also suggest that the linearity relationship, if it exists, can be confirmed only in the relationship between deposition at relatively remote northeastern sites and emissions in the Northeast itself, but not emissions in more distant source regions. This conclusion provides an important qualification to the conclusions of the NAS (1983) study.

The linearity hypothesis cannot be used with confidence for projecting national control strategies until the apparent inconsistencies in the behavior of acid-forming substances in the atmosphere are better characterized in terms of emission patterns. At present, that hypothesis appears most applicable to the influence of SO_2 emission sources in the Northeast itself on wet sulfate deposition in relatively remote areas of the Northeast. Even this conclusion, however, is tentative. Aggressive efforts should be pursued to determine source-receptor relationships by analyzing new, higher quality wet deposition data acquired in the past five years, and comparing them with recent emission changes.

ATTACHMENT D

TABLE 1 1980 SO_2, NO_x and VOC Total Emission Density in the Northeastern States

(Tons Per Square Mile)

State	SO_2	NO_x	VOC	Total
Connecticut	14.4	26.8	73.3	114.5
Delaware	53.0	25.2	32.9	111.1
District of Columbia	220.9	326.9	526.6	1074.4
Maine	2.8	1.8	3.6	8.2
Massachusetts	41.7	30.7	71.7	144.1
Maryland	32.0	23.5	35.2	90.7
New Hampshire	10.0	6.0	10.9	26.9
New Jersey	35.6	51.8	103.4	190.8
New York	19.2	13.7	25.3	58.2
Pennsylvania	44.1	22.9	30.0	97.0
Rhode Island	12.5	30.1	98.7	141.3
Vermont	0.7	2.6	4.5	7.8
Regional Average	23.7	16.5	28.8	69.0

TABLE 2 1980 SO_2, NO_x and VOC Total Emission Density in Midwestern States (Tons Per Square Mile)

State	SO_2	NO_x	VOC	Total
Illinois	26.1	17.8	21.2	65.1
Indiana	55.2	21.3	18.9	95.4
Kentucky	27.1	13.2	10.7	51.0
Michigan	15.6	11.9	19.2	46.7
Missouri	18.7	8.1	9.9	36.7
Ohio	64.1	27.8	31.1	123.0
West Virginia	45.1	18.7	6.4	70.2
Wisconsin	10.7	7.5	9.4	27.6
Regional Average	29.1	14.6	15.9	59.6

ATTACHMENT E

SULFATE AIR POLLUTION HEALTH EFFECTS

A CRITICAL REVIEW OF OFFICE OF TECHNOLOGY ASSESSMENT DRAFT REPORT

"THE REGIONAL IMPLICATIONS OF TRANSPORTED AIR POLLUTANTS: AN ASSESSMENT OF ACIDIC DEPOSITION AND OZONE"

Section J and Appendix JJ

DU PONT ENGINEERING DEPARTMENT

T.A. Kittleman
Dr. J.L. Hess
Dr. R.D. Snee

DU PONT HASKELL LABORATORY

W.L. Sprout, MD

CONSOLIDATION COAL COMPANY

R.L. Kerch

CONOCO

Dr. W.C. Hamilton

The following has been excerpted from the above named report. The complete document has been retained in the committee files.

EXECUTIVE SUMMARY

Over the past ten years, reports have suggested that atmospheric sulfates in ambient concentrations may be responsible for tens of thousands of "excess deaths" a year in the United States. An interim draft prepared by a division of Brookhaven National Laboratory for the Office of Technology Assessment (OTA) estimated that sulfate pollutants in the United States and Canada accounted for 51,000 "excess deaths" in 1978. A Du Pont examination of Brookhaven's report shows that health, medical, and other scientific evidence will not support a conclusion that ambient sulfate concentrations cause mortality.

The Brookhaven estimate was made by multiplying three quantities: regional population, estimated regional sulfate concentration, and a sulfate mortality factor. While regional populations are accurately known, the accuracy of the sulfate concentration estimates are questionable. By far the least accurate of these quantities is the sulfate mortality factor.

The purported relationship between sulfates and mortality used by Brookhaven came from a paper that proposes a way to estimate uncertainty in predicted results of public policy decisions. For the example used to illustrate their method, the authors needed sulfate mortality estimates from a number of different investigations. Since few estimates based on actual mortality and air quality data were available, the authors had to rely on crude estimates and hours of "blackboard discussion" to hypothesize a distribution of mortality estimates. Brookhaven used this hypothetical distribution for their estimate and claimed it represented a balanced sampling of scientific opinion.

On close examination, no such balance is apparent. The hypothetical distribution relied heavily on the early work of two economists who used unsophisticated statistical techniques to derive their estimates. Many other scientists who specialize in epidemiology have criticized these estimates. They point out serious flaws in data collection, selection, and statistical modeling. More recent studies use sounder data collection and analyses, and suggest that *no* mortality results from existing ambient sulfate levels. In fact, controlled human experiments show that medically significant changes do not generally occur below concentrations more than ten times higher than the highest ambient levels we observe now.

Following its publication the originators of the hypothetical distribution used by Brookhaven reconsidered this distribution, and designed a more rigorous technique to obtain a distribution from expert opinions. They found that the collective opinions of the health researchers interviewed did not support the distribution used by Brookhaven. Furthermore, they found considerable doubt among those interviewed as to whether ambient sulfate concentrations would cause any mortality.

The highly publicized mortality estimate was based on work where the primary objective was not to estimate health effects of sulfates but rather to illustrate a way to consider uncertainty in public decision making. The sulfate mortality factor is based on outdated and flawed data. Atmospheric sulfates at present concentrations do not appear to threaten public health.

Section 1: TECHNICAL SUMMARY

Over the past two decades, numerous allegations have been made that air emissions from fossil fuel fired power plants have caused adverse health effects. The latest in this series concerns sulfates, which are formed in the atmosphere from sulfur dioxide. A recently released Office of Technology Assessment (OTA) Interim Draft Report (1982), "The Regional Implications of Transported Air Pollutants: An Assessment of Acidic Deposition and Ozone," estimated that sulfur pollution in the U.S. and Canada caused "51,000 excess deaths" in 1978. This estimate was made for OTA under contract by the Biomedical and Environmental Assessment Division of Brookhaven National Laboratory in a document entitled "Long-Range Transport Air Pollution Health Effects." This latter report relied heavily on an article by Morgan *et al* (1978). The health effects portion of the Morgan *et al* (1978) paper in turn relied heavily on the work of Lave and Seskin (1977). A critical review of the Brookhaven report and the associated work of Morgan *et al* (1978) and Lave and Seskin (1977) is made in this report.

The mortality estimate in the Brookhaven report was obtained by multiplying three components — the population in each state, a predicted ambient sulfate concentration for each state, and a sulfate-mortality factor (excess deaths per unit of exposed population per unit of pollution) taken from Morgan *et al* (1978). Although there are uncertainties in the population exposure calculations, we have not addressed these. The sulfate-mortality factor, the most crucial of the three components, is misused and misrepresented in the Brookhaven report.

The Brookhaven sulfate-mortality estimate comes from a paper [Morgan *et al* (1978)] that proposed a methodology to "explicitly characterize and deal with uncertainty in the analysis of public policy." The authors illustrated how their methodology might be used to predict uncertainty with an example that required their having a sulfate-mortality distribution. They began the illustration with an analysis that relied principally on sulfate-mortality estimates made by Lave and Seskin. They then hypothesized a subjective probability distribution based on what they inferred from this analysis and other sulfate-mortality information then available. It is this subjective probability distribution, used in an example to simply illustrate a methodology for predicting the uncertainty in policy decisions, that is the basis for the Brookhaven sulfate-mortality estimate.

The Brookhaven report says that the Morgan *et al* (1978) illustration is based on a balanced consideration of "alternative formulations, including those of the Lave and Seskin critics who find no effects." This is not true. Of the four regression studies used in the Morgan *et al* (1978) example, three were from the Lave and Seskin book and the other was a comparison case that used Lave and Seskin's basic approach. In other words, the Brookhaven report's assertion that Morgan *et al* (1978) balanced Lave and Seskin studies with those of their critics is untrue. In fact, Morgan *et al* (1978) makes no such claim.

Since we presume that Morgan *et al* (1978) would have included more recent studies if they had been available, we broadened their example using more recent studies by Cooper and Hamilton (1979), Gibbons and McDonald (1981), Crocker (1979) and Lipfert (1980b), in addition to Lave and Seskin. This illustration gives an estimate of zero excess deaths rather than the 51,000 alleged in the Brookhaven report.

In fact Morgan and his colleagues recently revised their earlier work [Morgan *et al* (1982)]. They now believe that the sulfate health effect estimate depends totally on the particular health expert consulted, and that their subjective approach does not provide a reliable sulfate-mortality factor. In other words, they found no consensus among experts and concluded:

> "One can set a fairly high upper bound on the possible health impacts of chronic exposure to low level sulfate air pollution. Between this bound and the lower limit of no effect, there is no agreement across the set of air pollution health effects experts about the likely health impacts of sulfate. Within this group one can get almost any answer, including the answer that with 100 percent probability, there are no adverse health impacts, depending upon which expert one talks to."

Thus, we see that Morgan *et al* (1978) cannot be used to support the Brookhaven calculations of "excess death."

The only remaining basis that can be used to support the Brookhaven estimate is the work of Lave and Seskin.

All of the Lave and Seskin studies, as well as those of many of their critics, use rather limited, statistical techniques and are often referred to as "econometric epidemiology." Even among proponents of this type of epidemiology, Lave and Seskin have been criticized in peer reviewed literature. Among the many substantive criticisms are that:

- Lave and Seskin "forced" specific air pollution variables into their analyses regardless of their explanatory power.
- Their mortality data were from different years than were the pollution (sulfate and particulate matter) data.

- Their sulfate data were obtained before there were good analytical methods or uniform procedures to determine sulfates.
- The geographical areas used were too large to be accurately represented by the pollution measurements, which were usually from a single sampling station.
- Their methodology did not correct for such important parameters as smoking, diet, ambient temperature, in-and-out migration of people, or availability of medical care.

In light of these major defects in Lave and Seskin and the preponderance of contrary evidence from better studies, Lave and Seskin do not provide a sound basis for a health effects estimate. The 1978 National Academy of Sciences (NAS) monograph "Sulfur Oxides" and the Clean Air Science Advisory Committee (CASAC) Draft Comments on air quality standards both concluded that Lave and Seskin's work should not be relied upon for regulatory or policy making support. In fact, others have demonstrated, eg, Lipfert (1980a), that models with only socioeconomic variables explain mortality differences between SMSA's as well as they do with the inclusion of air pollution variables. A review of currently available studies leads clearly to one conclusion; if sulfate does cause mortality, it is too small to detect by currently available techniques. The sulfate-mortality estimates made by Brookhaven, and included in the OTA assessment, have no credible scientific basis.

Review of medical data shows that no health effects should occur at existing ambient sulfate concentrations. Even in deliberate, controlled experimental human exposures, no medically significant changes have been demonstrated at levels below 1000 $\mu g/m^3$. 1000 $\mu g/m^3$ is far above even the highest ambient levels now being recorded (typically 50-80 $\mu g/m^3$).

In conclusion, we are convinced that the calculations leading to a projection of thousands of "excess deaths" each year as a result of exposure to sulfates in the ambient air are erroneous. The only reasonable conclusion that can be drawn is that if any "excess deaths" are caused by sulfate exposure, they are too few to be quantified.

Final Report

MODELING STUDIES OF SULFATE AND NITRATE CHEMISTRY

The Effect of Changes in Sulfur Dioxide, Nitrogen Oxide, and Reactive Hydrocarbon Levels

SYSAPP-84/013

19 January 1984

Prepared for

Consolidation Coal Company
Consol Plaza
Pittsburgh, PA 15341

and

Peabody Coal Company
P.O. Box 14495
St. Louis, MO 63178

Prepared by

Christian Seigneur
Pradeep Saxena
Marianne Dudik
Gary Z. Whitten
Philip M. Roth

Systems Applications, Inc.
101 Lucas Valley Road
San Rafael, CA 94903

62610 ef 83148r2

The following has been excerpted from the above named report. The complete document has been retained in committee files.

EXECUTIVE SUMMARY

Evidence of lake acidification in northern America and Scandinavia has been reported in recent years. It has been suggested that anthropogenic emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x) upwind of watersheds sensitive to acidification may be the cause of the decreasing pH of lakes as a result of SO_2 and NO_x oxidation to sulfate and nitrate, respectively. Thus, it appears that mitigation of the acid deposition problem will require a reduction in ambient concentrations of sulfates and nitrates through control of their rate of formation in the atmosphere. However, because of the complex nonlinear aspects of atmospheric chemistry, reductions in concentrations of anthropogenic precursors SO_2 and NO_x often do not lead to equivalent reductions in sulfate and nitrate concentrations, respectively. In addition, the chemical reaction of reactive hydrocarbons (RHC) with NO_x determines the ambient levels of oxidants in the atmosphere and therefore affects the rates of SO_2 and NO_x oxidation. Thus, changes in RHC concentrations will affect acid species concentrations.

Mathematical models of atmospheric chemical kinetics can be used to calculate the effect of precursor levels on acid species concentrations. This paper presents the results of simulations of the atmospheric chemistry of sulfate and nitrate formation performed to investigate the effect of changes in SO_2, NO_x, and RHC levels on sulfate and nitrate concentrations for conditions typical of midwestern and northeastern America. Our model calculations suggest that there are strong nonlinearities in the atmospheric chemistry of acid species.

The mathematical model used for this investigation provides a detailed treatment of the chemistry of 54 chemical species including sulfate, nitrate, SO_2, NO_x, RHC, O_3, and H_2O_2 in the gas phase and in cloud droplets. Gas-phase chemistry in the model is described by 80 chemical reactions among 38 chemical species and has been extensively validated with experimental data. The following major reactions lead to acid formation in the gas phase:

$$SO_2 + OH \xrightarrow{H_2O} H_2SO_4 + HO_2$$

$$NO_2 + OH \rightarrow HNO_3$$

$$NO_2 + NO_3 \rightleftarrows N_2O_5 \xrightarrow{H_2O} 2HNO_3$$

Gas-phase/liquid-phase equilibria are treated by means of Henry's law constants for 11 chemical species (SO_2, NO, NO_2, O_3, H_2O_2, CO_2, HCHO, NH_3, HNO_3, HNO_2, and H_2O).

It is assumed that mass transfer between the gas phase and the liquid phase is limited by the liquid-phase chemical reaction rates. Thus, the species concentrations are uniform in both the gas phase and the liquid phase and are related by the thermodynamic equilibrium relationship: $X_L = K X_G$, where X_L and X_G are the liquid-phase and gas-phase concentrations, respectively, and K is the Henry's law constant. Sulfuric acid and radicals are assumed to be transferred from the gas phase to the liquid phase by a diffusion-limited process. The scavenging efficiency of radicals by droplets is assumed to be 1 percent.

The liquid-phase chemistry occurring in cloud droplets involves a total of 12 chemical equilibria and 14 irreversible reactions among 16 chemical species including sulfates, nitrates, SO_2, O_3, H_2O_2, O_2, and HCHO. The liquid phase satisfies electroneutrality. The nonideality of the solution is calculated according to Saxena and Peterson. The following major reactions lead to acid formation in the liquid phase:

$$S(IV) + O_3 \rightarrow S(VI)$$

$$S(IV) + H_2O_2 \rightarrow S(VI)$$

$$S(IV) + O_2 \xrightarrow{Fe^{3+},\ Mn^{2+}} S(VI)$$

The rate of the O_3 reaction decreases as the pH decreases; this oxidation pathway is therefore self-limiting. The rate of the H_2O_2 reaction increases as the pH decreases; however, this reaction may be oxidant-limited. The oxidation of S(IV) catalyzed by trace metals is zero-order with Mn^{2+}, first-order with Fe^{3+}, and synergism may occur when both metals are present.

Since gas-phase chemistry is strongly dependent on photochemical rates, the model takes into account the time dependence of solar irradiation. Dry deposition on the ground is treated with deposition velocities of 1 $cm{\cdot}s^{-1}$ for gases and 0.1 $cm{\cdot}s^{-1}$ for aerosols. The model does not treat turbulent diffusion, and is therefore representative of a well-mixed atmosphere with uniformly distributed emission sources. Model simulations were conducted for daytime conditions only so that the assumption of a well-mixed atmosphere would apply.

No data base exists for the quantitative evaluation of a cloud chemistry model. However, it was possible to evaluate qualitatively the ability of the model to reproduce the major features of atmospheric cloud chemistry by comparing model calculations with several sets of ambient measurements collected under various conditions. Such comparisons were conducted for nonraining clouds in the Adirondacks, raining clouds in the Ohio River valley, and nighttime fog in the Los Angeles basin. The model reproduced well observed concentrations of sulfate, nitrate, and cloud pH within the range of experimental uncertainties. For example, simulations of three-hour cloud events under conditions typical of those at Whiteface Mountain in the Adirondacks were carried out for various seasons and times of day. Calculated amounts of sulfate and nitrate at the end of the simulations ranged from 2 to 6.5 $\mu g.m^{-3}$ and 0.7 to 2.2 $\mu g.m^{-3}$, respectively. On the average, measured concentrations were 4 $\mu g.m^{-3}$ for sulfate and nitrate, respectively. The calculated pH at the end of the

TABLE S-1. Initial concentrations and continuous emissions used in the model simulations.

Species	June Simulations	
	Initial Concentrations	Emission Fluxes
Sulfate	1 $\mu g \cdot m^{-3}$	--
Nitrate	1.3 $\mu g \cdot m^{-3}$	--
SO_2	0.010 ppm	288 $kg \cdot ha^{-1} \cdot y^{-1}$
NO_x	0.006 ppm	124 $kg \cdot ha^{-1} \cdot y^{-1}$
RHC	0.015 ppm	109 $kg \cdot ha^{-1} \cdot y^{-1}$
NH_3	0.001 ppm	--
H_2O_2*	0.001 ppm	--
O_3	0.045 ppm	--
CO_2	320 ppm	--

Species	December Simulations	
	Initial Concentrations	Emission Fluxes
Sulfate	0.20 $\mu g \cdot m^{-3}$	--
Nitrate	0.26 $\mu g \cdot m^{-3}$	--
SO_2	0.010 ppm	288 $kg \cdot ha^{-1} \cdot y^{-1}$
NO_x	0.006 ppm	124 $kg \cdot ha^{-1} \cdot y^{-1}$
RHC	0.015 ppm	109 $kg \cdot ha^{-1} \cdot y^{-1}$
NH_3	0.001 ppm	--
H_2O_2*	0.001 ppm	--
O_3	0.045 ppm	--
CO_2	320 ppm	--

* 0 ppb for gas-phase simulations, since the chemical kinetic mechanism calculates H_2O_2 formation during the course of the simulation.

simulations ranged from 3.6 to 4.2. The average observed pH was 3.9. The lower sulfate/nitrate ratio observed in the winter was also reproduced by the simulations.

Four simulations typical of conditions in the midwestern and northeastern United States were conducted: simulation of the atmospheric boundary layer without clouds and simulation of an elevated stratus cloud layer; each of these simulations was conducted for two sets of seasonal conditions, June and December. Boundary-layer simulations were conducted for a 12-hour daytime period from 0600 to 1800. Cloud-layer simulations were conducted for a 3-hour period from 1000 to 1300, since cloud lifetime is on the order of a few hours. Ground-level dry deposition was not considered for the cloud simulations. The June and December simulations were performed to investigate the effect of solar irradiation on chemical kinetics. The initial conditions and emission rates used in these four simulations are presented in Table S-1.

The levels of SO_2, NO_x, and RHC were independently reduced by 50 percent for each of the four scenarios. Changes in the amounts of sulfate and inorganic nitrate formed due to changes in the precursor levels are presented in Table S-2. These results can be summarized as follows.

A reduction in SO_2 emission levels leads to a reduction in sulfate levels. Model calculations suggest that the relationship between sulfate and SO_2 is nearly linear in a cloud-free atmosphere, but is strongly nonlinear if cloud chemistry takes place. In the latter case, sulfate formation occurs primarily in the liquid phase through the reaction of dissolved SO_2 with H_2O_2 and O_3. The net effect of SO_2 reduction on sulfate formation depends on the relative contributions of dry gas-phase and cloud processes, as shown in Figure S-1. For example, if we assume that cloud processes account for 50 percent of atmospheric chemistry, a 50 percent reduction in SO_2 levels leads to a 36 percent reduction in sulfate. Reductions in SO_2 levels have a negligible effect on nitrate formation.

TABLE S-2. Model simulation results. Changes in sulfate and inorganic nitrate concentrations (percent) due to reductions of precursor levels.

Variable	Scenario		
	50% Reduction in SO_2 Levels	50% Reduction in NO_x Levels	50% Reduction in RHC Levels
June gas-phase chemistry			
Sulfate	-48	-18	+9
Nitrate	+1	-55	+11
December gas-phase chemistry			
Sulfate	-48	-9	-9
Nitrate	0	-58	+4
June cloud chemistry*			
Sulfate	-22	+30	-7
Nitrate	0	-41	-9
December cloud chemistry*			
Sulfate	-26	+33	-5
Nitrate	+2	-32	-9
Average†			
Sulfate	-36	+8	-2
Nitrate	+1	-46	-1

* Cloud chemistry includes interstitial gas-phase chemistry and cloud droplet aqueous-phase chemistry.

† The average is calculated from the arithmetic mean of the June and December simulations and assuming that half the sulfate and nitrate is formed in clouds.

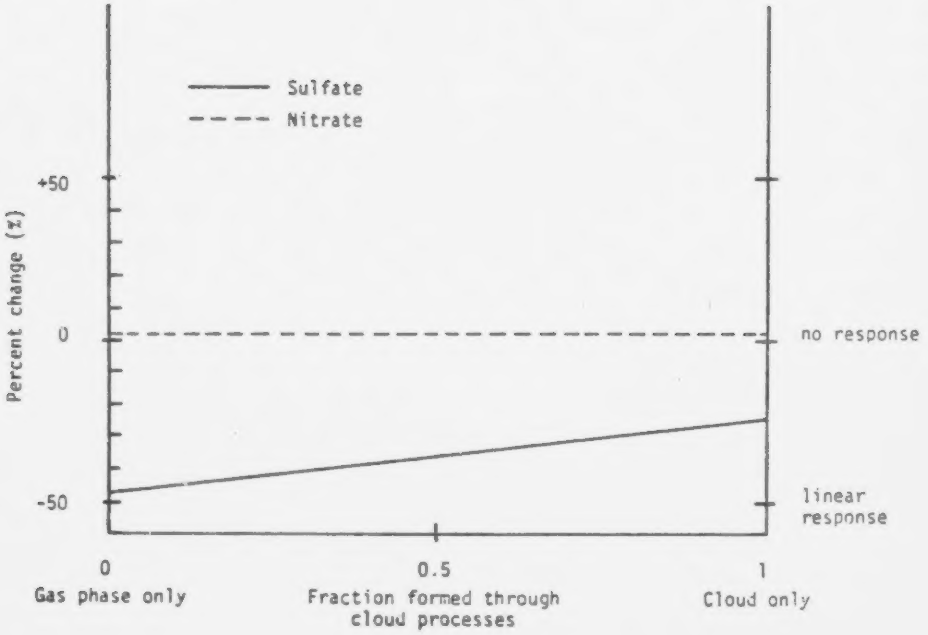


FIGURE S-1. Percentage changes in sulfate and nitrate formation due to a 50 percent reduction in SO_2 levels.

Our model calculations show that a reduction in NO_x levels leads to a decrease in nitrate formation; this decrease is more important for dry gas-phase chemistry than for cloud chemistry. A reduction in NO_x emissions leads to a slight reduction in sulfate formation in the case of dry gas-phase chemistry but to a notable increase in sulfate formation in the case of cloud chemistry. The net effect of NO_x reduction depends on the relative importance of both processes, as shown in Figure S-2.

Calculations indicate that a 50 percent reduction in RHC could lead to either a slight increase or decrease in sulfate and nitrate formation, depending on both the season and the occurrence of cloud chemistry, as shown in Figure S-3. If we assume that half of all sulfate and nitrate is formed in clouds, the model predicts little change in acid species concentrations as a result of reductions in RHC levels.

In summary, our model calculations suggest that, for the conditions considered, reductions in SO_2 and NO_x lead to nearly equivalent reductions in sulfate and nitrate, respectively, for dry gas-phase conditions; however, such reductions lead to significantly less reduction in acid levels when cloud chemistry occurs. Changes in RHC levels do not seem to have significant effects on acid levels.

These calculations should be seen as illustrative of atmospheric chemistry, recognizing that treatment of atmospheric transport is required for a more accurate definition of the relationship between atmospheric acid levels and their precursors. For example, entrainment of air into the clouds would maintain higher oxidant concentrations than those calculated in our simulations and would lead to less nonlinearity between SO_2 and sulfate concentrations. Refinements of the chemical mechanism may also be required as our knowledge of atmospheric chemistry improves. Nevertheless, the model reported here is based on a detailed treatment of gas-phase and liquid-phase chemistry and may therefore be considered to be an effective tool for the analysis of atmospheric acid chemistry.

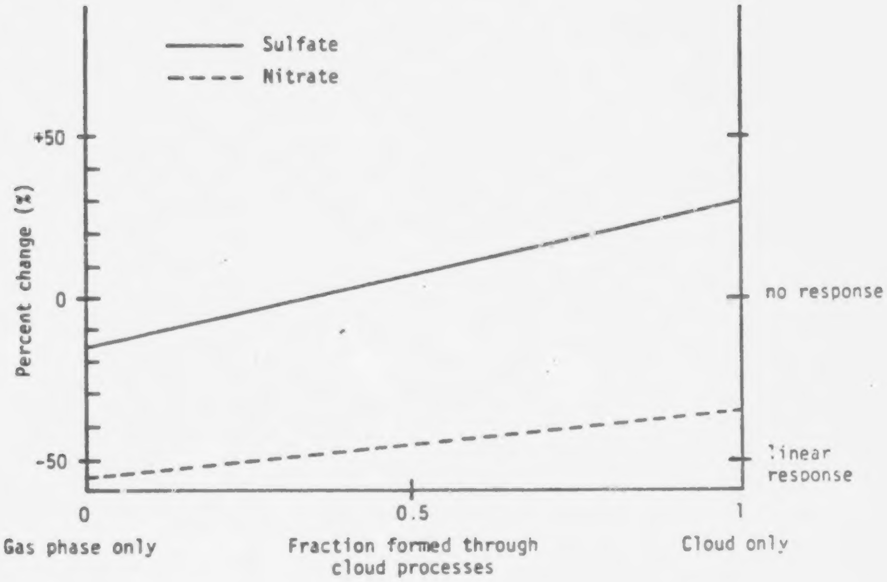


FIGURE S-2. Percentage change in sulfate and nitrate formation due to a 50 percent reduction in NO_x levels.

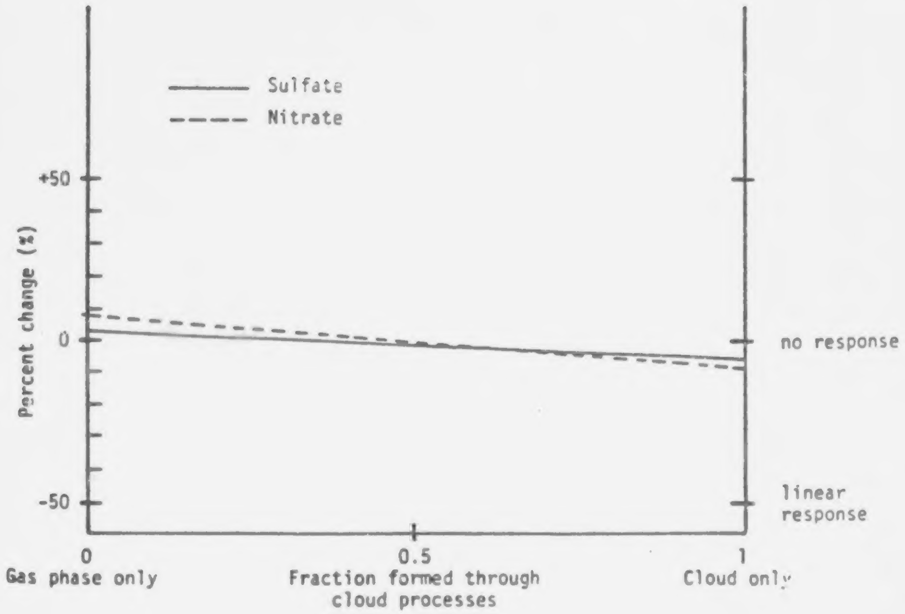


FIGURE S-3. Percentage change in sulfate and nitrate formation due to a 50 percent reduction in RHC levels.

ELCON

STATEMENT OF THE
ELECTRICITY CONSUMERS RESOURCE COUNCIL

TO THE
UNITED STATES SENATE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ON
PROPOSED ACID RAIN LEGISLATION

FEBRUARY 10, 1984

Electricity Consumers Resource Council (ELCON)
1828 L Street, N.W., Suite 403
Washington, D.C. 20036
(202) 466-4686

The Electricity Consumers Resource Council (ELCON) is pleased to submit the following statement to the Committee on Environment and Public Works of the United States Senate. The purpose of this statement is to present ELCON's views on current legislative proposals to impose an emissions reduction program on the nation's electric utilities.

ELCON is an association of sixteen large industrial consumers of electricity with facilities in most of the fifty states.[1] ELCON's members consume approximately 10 percent of all electricity sold to industrial consumers and nearly 5 percent of all electricity sold in the U.S.

Because of our members' use of electricity, ELCON has a significant and continuing interest in the electric utility industry. ELCON advocates and promotes the development and adoption of coordinated, rational and consistent federal, state and local policies which will assure an adequate, reliable and efficient electricity supply for all users at prices based on the costs incurred in providing service. Due to the impact of any acid rain legislation on the cost and reliability of electric service, ELCON has a significant interest in the proposed legislation. We appreciate this opportunity to comment on this important issue.

ELCON has reviewed the statement of EPA Administrator Ruckelshaus presented before this Committee on February 2, 1984. On that basis, we support the position of the Reagan Administration which calls for increased and accelerated research of the acid rain phenomenon, increased research and development for improved control technology and liming of affected lakes to mitigate the effects of acidity while research continues.

---

[1] This statement is presented on behalf of the following ELCON members: Air Products and Chemicals, Inc.; Anheuser-Busch Companies, Inc.; Armco Inc.; Bethlehem Steel Corporation; Diamond Shamrock Corporation; Dow Chemical U.S.A.; E.I. du Pont de Nemours & Company; General Motors Corporation; Kaiser Aluminum & Chemical Corporation; LCP Chemicals & Plastics, Inc.; Olin Corporation; PPG Industries, Inc.; Stauffer Chemical Company; and Union Carbide Corporation.

Industrial consumers of electricity are concerned about the environment, and we expect to pay our fair share of any necessary program. However, we are forced to deal with the facts of the marketplace. During these times of increasing competition in world and domestic markets, we must be certain that any additional cost imposed on U.S. industry generates a benefit at least equal to that cost.

Industrial consumers of electricity are concerned that the debate over acid rain will degenerate into an argument over whose estimate of the cost impact of an emissions reduction program is the most accurate. This argument ignores the benefit side of the equation.

Analyses of proposed emissions reduction programs indicate that, although costing tens of billions of dollars, these programs would cause only a temporary reduction in precursor emissions below levels which would exist without additional legislation. For example, a study performed for the U.S. Department of Energy states that emissions from coal-fired generating plants will decline continually as old units are retired.[2] When new plants with more advanced pollution control technology take the place of old ones, emission levels will be approximately the same with or without acid rain legislation. A similar analysis performed by the Electric Power Research Institute (EPRI) indicates that acid rain legislation would reduce emissions below otherwise achievable levels for a period of about twenty years (1985 to 2005).[3] After this period, emissions will be about the same with or without the legislation.

---

[2] Energy Information Administration, U.S. Department of Energy, Impacts of the Proposed Clean Air Act Amendments of 1982 on the Coal and Electric Utility Industries, June 1983.

We need to consider if this accelerated reduction in emission levels is worth its cost. That is, will the reduction in emissions result in a significant reduction in acid deposition and will that reduction produce benefits sufficient in dollar amount to justify the expenditure of billions of dollars? My understanding is that based on present scientific knowledge, this question cannot be answered with any appreciable degree of accuracy. Indeed, we at ELCON have seen no estimates or analyses that quantify the benefits to be gained from an emissions reduction program.

ELCON has allocated an appreciable amount of time and resources to the acid rain issue. Our interests in this issue are both economic and environmental. We are concerned about the environment, but we are also concerned that any program designed to reduce emissions that may affect the environment be based on sound technology and economic reasoning. The Congress must make hard economic decisions based on verifiable evidence with predictable (if uncertain) results. Consumers cannot afford to spend billions of dollars annually on a program that has only uncertain and unquantified benefits. Decisions involving such a large commitment of our nation's resources should be based on some reasonable probability of attaining a favorable benefit-cost result. Since the environment is such an important national priority, decisions of this magnitude affecting the environment are important enough to be based on scientific evidence, not rhetoric.

---

[3] Electric Power Research Institute, "Developing the Options for Emissions Control," in EPRI Journal, Vol. 8, No. 9, November 1983.

Estimates of the cost of an emissions reduction program vary significantly and are based on a number of uncertain assumptions, including: the capital cost of retrofitted scrubbers; the fuel and operating and maintenance (O&M) expense associated with this technology; the availability of new, less costly technology; the price differential and availability of low-sulfur versus high-sulfur coal; interstate and intrastate trading of emissions reductions; protection of local coal sources; and coal transportation costs. In addition, the capital cost and fuel and O&M expense associated with current scrubber technology are highly site specific. Actual costs may vary substantially from estimates once an emissions reduction program is underway. Also, different legislative proposals have different regional impacts depending upon the specific language and implementation programs incorporated in the bill.

ELCON has analyzed a number of studies that provide cost estimates of emissions reduction programs. Some of these are associated with particular legislative proposals, others estimate the cost of specific levels of emissions reduction.[4] ELCON cannot vouch for any particular one of these estimates, since they are based on a number of uncertain and often unspecified assumptions. The important point is that all of these estimates are quite large, ranging from $1.8 billion to $24.9 billion in total cumulative capital costs and $3.3 billion to $7.9 billion in total annual costs.[5]

---

[4] These studies are: Edison Electric Institute, "A Report on the Results from the Edison Electric Institute Study of the Impacts of the Senate Committee on Environment and Public Works Bill on Acid Rain Legislation (S. 768)," by National Economic Research Associates, Inc., June 20, 1983; Edison Electric Institute, "Evaluation of H.R. 3400, The Sikorski/Waxman (Footnote Continued)

The cost of the emissions reduction programs currently proposed can have a significant impact on electricity prices, on the costs of industrial firms and ultimately on consumer prices. An analysis sponsored by ELCON and the Aluminum Association determined that state average industrial electric rates could increase as much as 20 percent and residential rates by more than 13 percent due to an emissions reduction program.[6] Actual cost impacts on individual utility systems within a state would vary considerably. In addition, even though industrial rates have risen much more than residential rates over the past ten years (327 percent increase for industrials vs. 180 percent for residentials for 1972-1982), it is possible that residential opposition to rising electricity rates will cause a

---

(Footnote Continued)
Bill for Acid Rain Abatement," by Temple, Barker and Sloane, Inc., September 20, 1983; Energy Information Administration, U.S. Department of Energy, Impacts of the Proposed Clean Air Act Amendments of 1982 on the Coal and Electric Utility Industries, June 1983; ICF, Inc., "Analysis of Coal Production and Employment Impacts of the Waxman-Sikorski Bill and a Cost-Effective Equivalent," for the Alliance for Clean Energy, September 22, 1983; ICF, Inc., "Potential Impacts of Alternative Acid Rain Initiatives on Electric Utility Rates in the U.S.," for the Aluminum Association and ELCON, August 18, 1983; ICF, Inc., Analysis of a Senate Emission Reduction Bill (S. 3041), Environmental Protection Agency, February 1983.

[5] These estimates are for a 10 million ton reduction in emissions below 1980 levels for the 31 eastern states.

[6] ICF, Inc., "Potential Impacts of Alternative Acid Rain Initiatives on Electric Utility Rates in the U.S.," op. cit.

disproportionate share of emission reduction costs to be borne by industrial customers.

Some utilities predict rate increases of 30 percent to 50 percent, while others expect very small rate increases or none at all. This type of random cost impact would have a deleterious effect on U.S. industry. It would disrupt present cost relationships and competitive positions and make production scheduling and corporate planning extremely hazardous. Increased electricity costs will make it even more difficult for capital intensive industries (such as steel, autos, aluminum and chemicals) to invest in long neglected new plant and equipment.

In addition to capital cost increases, utilities would experience increased fuel and O&M expenses due to proposed acid rain legislation. These costs could be two or three or more times as much as associated capital costs on an annual basis. While some legislative proposals include a generation tax designed to distribute most capital costs of an emissions reduction program among a large number of customers, increased fuel and O&M expenses are very difficult to spread and thus would be borne directly by an affected utility's customers. I simply want to point out that while the capital costs of proposed programs are estimated to be in the billions of dollars annually, associated annual fuel and O&M expenses are expected to be even higher.

Several issues have been neglected in the many discussions of acid rain impact. There is a serious question as to the impact acid rain legislation might have on the demand for and price of OPEC oil. Certainly, utilities would be encouraged to continue burning oil when they have the capacity to do so rather than spend huge sums on new units or plant modifications. This fact combined with a lack of enthusiasm for nuclear units might jeopardize the electricity supply system in the near future.

You have heard substantial comment by ELCON and others as to the dollar cost of an emissions control program. The important issue is the real cost to the U.S. and its standard of living if tens of billions of dollars worth of resources are used to control acid rain with no assurance of an equivalent real benefit. Those resources have alternative uses in the private and public sector for schools, medical care, roads, etc. If used to control acid rain, then by definition they are not available for other real income purposes. It is this cost that is important.

In conclusion, ELCON is concerned about the impact that proposed acid rain legislation would have on U.S. industry and the U.S. generally. We agree with others that acid rain is a problem. However, we believe that Congress must consider the effectiveness of proposed legislation in achieving its goals and the likely cost burden associated with that legislation.

ACID RAIN -- A FOREST INDUSTRY VIEW

DR. ELY GONICK
SENIOR VICE PRESIDENT FOR TECHNOLOGY
INTERNATIONAL PAPER COMPANY

The Forest Products Industry depends on an abundant supply of trees for its raw material and uses large quantities of energy to convert those trees to finished products. In 1982 the finished products were valued at 120 billion dollars so the industry is an important part of the U.S. economy. Acid rain is now claimed by some scientists and environmentalists to harm the forest and if the claims are true, the Forest Products Industry's raw material supply could be jeopardized. The National Coucil for Air & Stream Improvement, a technical organization supported by the paper industry, is studying whether those claims of harm are true. In March of this year I gave a talk on acid rain before this National Council on Air & Stream Improvement at its Annual Meeting urging that we get the facts on acid rain effects on the forests before legislation is enacted to control acid emissions.

Prior to this March 1983 meeting, I knew little of the technical literature on acid rain. What I knew came largely from newspaper and magazine reports, the same sources the public gets its information from. These publications said that:

- Acidic deposition in Northeast U.S. & Eastern Canada emanates largely from the Midwest-U.S. utilities.
- The sulphur dioxide and nitrogen oxide are formed in combustion of the high sulphur bituminous coals which they use.

- The pH of the rain falling in the Northeast typically ranges between 4.1 and 4.5, i.e. highly acidic.
- Northeastern U.S. has low buffer capacity and does not neutralize the acid very well.
- The run-off of the acid deposited can be quite acidic and is responsible for the acidification of the Northeastern lakes, ponds, and streams.
- This acidification harms and alters the fish life and other forms of life in the water.
- The decline of trees at Camel's Hump and in central Europe is caused by acid rain which solubilizes aluminum which is toxic to trees.
- The Northeastern forests are in danger of serious decline.

The reports seemed to add up to an open and shut case, i.e., reduce evolution of acid gases sufficiently and the Northeastern forests and waters of the U.S. and Eastern Canada will be restored to an earlier healthier less acid condition. Clearly, the Canadian Government and our public, and some members of Congress, now believe that the remedy is to scrub the SO_2 out of the Midwestern utility boilers and pressure is mounting for such action. The attention is now focusing on how much to scrub and who pays. The question of who pays is leading to quarrels between the Midwest and Northeast as well as other regions depending on whose economy is damaged.

Well, as I mentioned earlier, in preparing for my talk to the National Council, I concluded that I ought to go to the scientific literature rather than depend solely on the newspapers and magazines, i.e., the popular literature. What I have discovered is an impressive series of articles which support the media information on the sources of the acid deposition but contradict the statements that acid deposition has much to do with the acidification of the waters or damage to trees. Many scientific papers report that acidification is largely the result of natural processes of decomposition of litter from the forest, that conifers are particularly strong acid formers and that as much as 90% of the acid in run-off from coniferous areas is natural in origin. Let me cite some points from the scientific literature which dispute that acid deposition significantly acidifies waters and harms trees:

- On the West Coast studies show that rain at pH 5.6 (the pH of rain which does not contain SO_2 or NO_x and in equilibrium with atmospheric CO_2) which falls on the coniferous forest leads to run-off of pH 4.0. Obviously, the major acidification of run-off to pH 4.0 from 5.6 was due to natural acidification, not manmade acid rain.
- The pH of litter under conifers in Maine will typically run 3.0 - 3.5 -- representing an acidity ten times greater than the acid deposition in that region which averages about 4.3.

- Drought in the late 1950's, rather than acid rain, is a much more probable cause of the red spruce decline at Camel's Hump, according to Siccama and Johnson, based on analysis of meteorological data.
- Studies on the effect of soluble aluminum concentration on tree root mass do not show toxic effects until the concentration of aluminum exceeds 100 ppm. Dr. Ulrich, who studied the declining Sollingen forest, claims that acid rain makes aluminum soluble and the soluble aluminum is responsible for tree root damage. The concentration of soluble aluminum under the conditions he cites has been calculated to be 2 ppm. Incidentally, the decline of red spruce is also attributed to aluminum by Professor Vogelmann. But red spruce decline was noted in the last century when acid rain was not a factor.
- Studies show that scrubbing of 10 MM tons of SO_2 would only raise pH of run-off by about 0.1 pH units, a minor change.
- Many forest regions now are more acid than formerly, not because of acid deposition but because forests that were cut over or burned over, due to unchecked forest fires, are reverting to an earlier more acid condition.

> Solubilization of aluminum in the Northeast is not recent either since pH of coniferous forests is low enough to solubilize aluminum even where acid rain is not involved. In fact, this solubilization is one of the ways that soil has been forming since the glaciation period of about 12,000 years ago.

To satisfy my curiosity, I thought it might be interesting to make some admittedly rough calculations based on forest data in Maine on how the coniferous forest there might affect the pH of the waters. The Department of Agriculture provides detailed data on the forests there. Briefly:

- Maine has half the area of New England - over 33,000 square miles.
- 87% of Maine is forested.
- 51% of the total forest is Spruce/Fir or 44% of the total land area of Maine.

Since International Paper owns an appreciable acreage (1.1 million acres of land in Maine), we sampled three different soils representing good, intermediate, and poor growing sites for conifers to analyze for pH and total acidity. The results are shown on these photographs of the soil. Chart 1 summarizes the data. To simulate run-off we also determined the influence of humus and soil on the pH of water. In these cases water of 4.2 and 5.6 pH was added to the humus/soil mixture and the pH measured. This was done at 2 addition levels of water. 10 grams and 50 grams of water per 2 grams of humus or soil. The results are shown on Chart II.

CHART I

pH of Humus & Soil Horizon (A)

Site	Humus	A Horizon
Good	3.2	3.1
Intermediate	3.1	3.0
Poor	2.6	3.6

CHART II

Acidification of water by a blend of 1g of humus and 1g of A Horizon soil to simulate run-off

	pH 4.2		pH 5.6	
Site	10 ml	50 ml	10 ml	50 ml
Good	4.3	4.3	4.4	4.5
Intermediate	4.1	4.3	4.3	4.7
Poor	4.0	4.1	4.4	4.4

The acid content of an acre of humus + A Horizon on the good site totalled 5100 equivalents of hydrogen ion vs. only 100 equivalents per acre contributed by 40" of annual rainfall at pH 4.3.

Admittedly, these are limited data but they give an order of magnitude picture of acid contained in natural conifer sources only vs. the contribution by acid rain. The data indicates that removal of acid due to acid rain would alter pH of Maine's waters by a trivial amount. Does this acid removal warrant a 4 billion dollar per year control program? Doubtful. Would it have any significant effect on the environment? Doubtful. In fact, the 1982 Annual Report of the National Acid Precipitation Assessment Program addressed to the President and Congress asked a series of questions and provided answers. First question asked was "Does acid deposition significantly affect aquatic resources, crops, soils, forests, materials, or human health?" Answered by saying, "Except for poorly buffered lakes, evidence on other actual impacts is inconclusive. The National Program included intensive laboratory and field studies to develop a more definitive understanding of the potential for damage to sensitive resources." We need to get before our public this kind of information so they can make known through the Congress whether they are willing to pay the bill for control of SO_2 emissions now for the minimal benefits that would result.

We, in the forest products industry, have a very strong interest in knowing whether a reduction in acid deposition will affect forest productivity. If it is harmful, we need to know how harmful, and what remedies are needed and their cost, for we cannot afford to lose our raw material supply, but if acid deposition has little effect on the forest or waters, as we suspect, we should not have to incur costs to control acid deposition. It is clear, at this time, there is no significant data that shows acid deposition hurts trees. I think we should defer legislation until we can determine that there is real and significant adverse effects that would be remedied by a control program.

Unfortunately, there already is a significant and premature impetus for legislation to control emissions. This impetus for control legislation has behind it a number of scientific advocates who have become moral crusaders where the facts have now become less important than some higher truths. To quote Bertrand Russell, the eminent philosopher, on this subject in an essay titled "History as an Art," - "In shops they have a maxim, 'the customer is always right' but Academic persons (among whom I should wish to include myself) are more lordly than shopkeepers. If the consumer does not like what he is offered, that is because he is a Philistine and because he does not know what is good for him. Up to a point I sympathize with this attitude. It would never do for a mathematician to try to please the general reader.

The physical sciences in their most serious aspects must be addressed primarily to specialists, though their more adventurous practitioners write occasional books designed to make your flesh creep. But, such books are not regarded by their fellow scientists as part of their serious work and detracts rather than add to their professional reputation."

I do believe scientists have the obligation of providing the public through the media with a balanced scientific picture in language the public can understand. This is not happening on the environmental effects of acid rain. Now is the time for scientists to straighten that record out not only with the media but also with our legislators and regulators. Let me close with a quote from an article by Bill Ruckelshaus in the September 7, 1983 issue of Science titled, "Science, Risk, and Public Policy."

"In a society in which democratic principles dominate, the perceptions of the public must be weighed. Instead of objective and subjective risks, the experts sometimes refer to "real" and "imaginary" risks. There is a certain arrogance in this -- an elitism that has ill served us in the past. As Thomas Jefferson observed, "If we think (the people) not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion." Now is the time to inform that discretion.

BIBLIOGRAPHY:

1. Influence of Forest Vegetation and Agriculture on the Acidity of Fresh Water by I. Th. Rosenquist "Advances in Environmental Science and Engineering" Vol. 3 (1980) Pfafflin, J.R., and E.N. Ziegler, Pages 56-78.

2. Sollins, P., C.C.Grier, F.M. McCorison, K. Cromark, Jr., R.Fogel, and R.L.Fredriksen, 1980. The Internal element cycles of an old growth Douglas-Fir ecosystem in Western Oregon. ·Ecol. Monogr. 50:261-285.

3. Spruce decline in the Northern Appalachians evaluating acidification as a possible cause. TAPPI 1983 Annual Meeting, Pages 301-309. A.H.Johnson & Thomas G. Siccama.

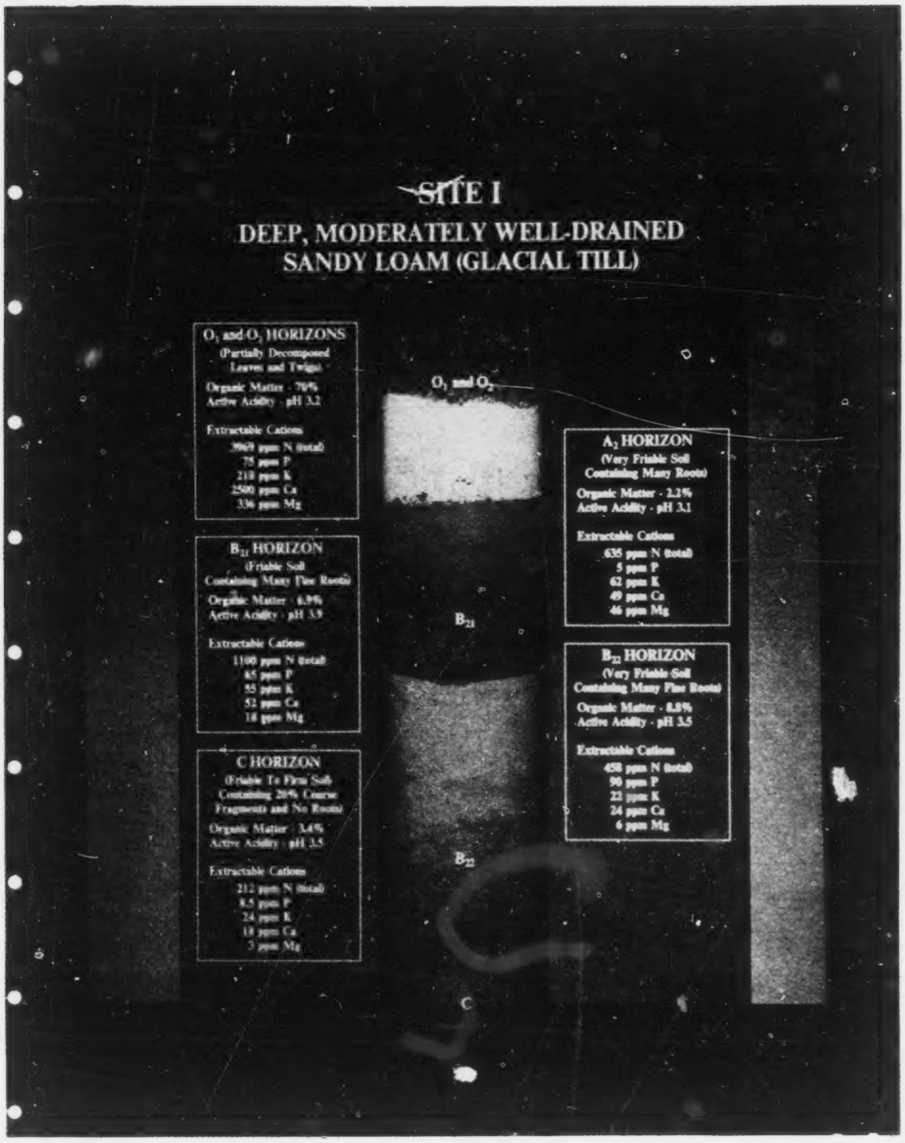
4. Whitehead, D.R., S.E. Reed, and D.F.Charles, 1981. Late glacial and postglacial changes in Adirondack lakes. Paper at symposium: Paleolimnological studies of lake acidification 1981. Annual meeting of the Ecological Society of America, Indiana University, Bloomington, Indiana, August 20, 1981.

   Ford, J. Interglacial perspective on ecosystem acidification. Paper at symposium cited in preceeding reference.

5. Atmosphere-Biosphere interactions. Fossil fuel combustion. National Academy Press, Washington, D.C. 1981, Page 167.

   Annual Report, 1982 prepared by Interagency Task Force on Acid Precipitation, Washington, D.C., Page 8.

   Hearings before Committee on Environment & Public Works-United States Senate, Ninety-Seventh Congress, Second Session. May 25 & 27, 1982, Serial No. 97-H53. Statement by Dale Johnson of Oak Ridge National Laboratory. Pages 394-398.



SITE I

DEEP, MODERATELY WELL-DRAINED SANDY LOAM (GLACIAL TILL)

O_1 and O_2 HORIZONS
(Partially Decomposed
Leaves and Twigs)

Organic Matter - 70%
Active Acidity - pH 3.2

Extractable Cations
3969 ppm N (total)
75 ppm P
210 ppm K
2500 ppm Ca
336 ppm Mg

B_{21} HORIZON
(Friable Soil
Containing Many Fine Roots)

Organic Matter - 6.9%
Active Acidity - pH 3.9

Extractable Cations
1100 ppm N (total)
65 ppm P
55 ppm K
52 ppm Ca
18 ppm Mg

C HORIZON
(Friable To Firm Soil
Containing 20% Coarse
Fragments and No Roots)

Organic Matter - 3.4%
Active Acidity - pH 3.5

Extractable Cations
212 ppm N (total)
8.5 ppm P
24 ppm K
18 ppm Ca
3 ppm Mg

A_2 HORIZON
(Very Friable Soil
Containing Many Roots)

Organic Matter - 2.2%
Active Acidity - pH 3.1

Extractable Cations
635 ppm N (total)
5 ppm P
62 ppm K
49 ppm Ca
46 ppm Mg

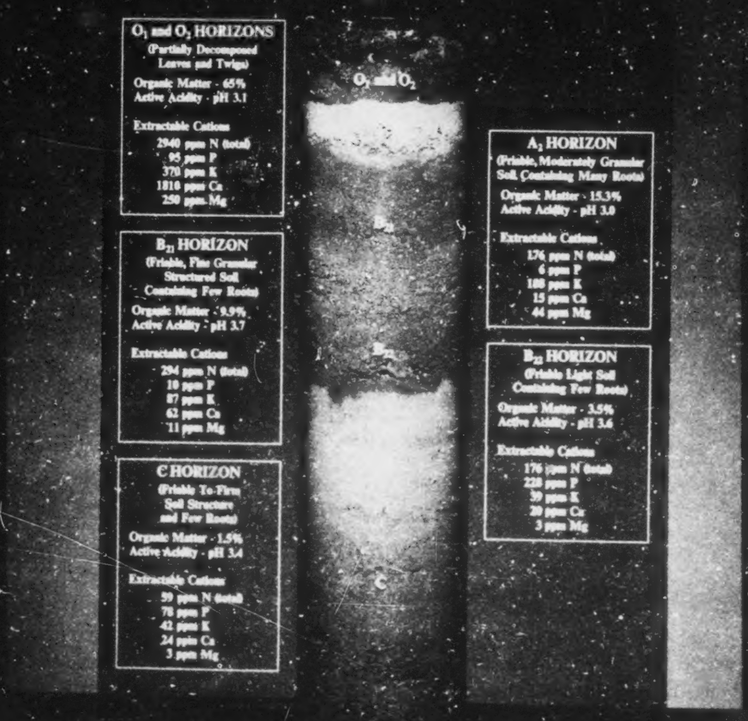
B_{22} HORIZON
(Very Friable Soil
Containing Many Fine Roots)

Organic Matter - 8.8%
Active Acidity - pH 3.5

Extractable Cations
458 ppm N (total)
90 ppm P
22 ppm K
24 ppm Ca
6 ppm Mg

SITE II

DEEP, POORLY DRAINED SANDY LOAM (LACUSTRINE DEPOSITS OR GLACIAL TILL)



O_1 and O_2 HORIZONS
(Partially Decomposed Leaves and Twigs)

Organic Matter - 65%
Active Acidity - pH 3.1

Extractable Cations
2940 ppm N (total)
95 ppm P
370 ppm K
1810 ppm Ca
250 ppm Mg

B_{21} HORIZON
(Friable, Fine Granular Structured Soil Containing Few Roots)

Organic Matter - 9.9%
Active Acidity - pH 3.7

Extractable Cations
294 ppm N (total)
10 ppm P
87 ppm K
62 ppm Ca
11 ppm Mg

C HORIZON
(Friable To Firm Soil Structure and Few Roots)

Organic Matter - 1.5%
Active Acidity - pH 3.4

Extractable Cations
59 ppm N (total)
78 ppm P
42 ppm K
24 ppm Ca
3 ppm Mg

A_2 HORIZON
(Friable, Moderately Granular Soil Containing Many Roots)

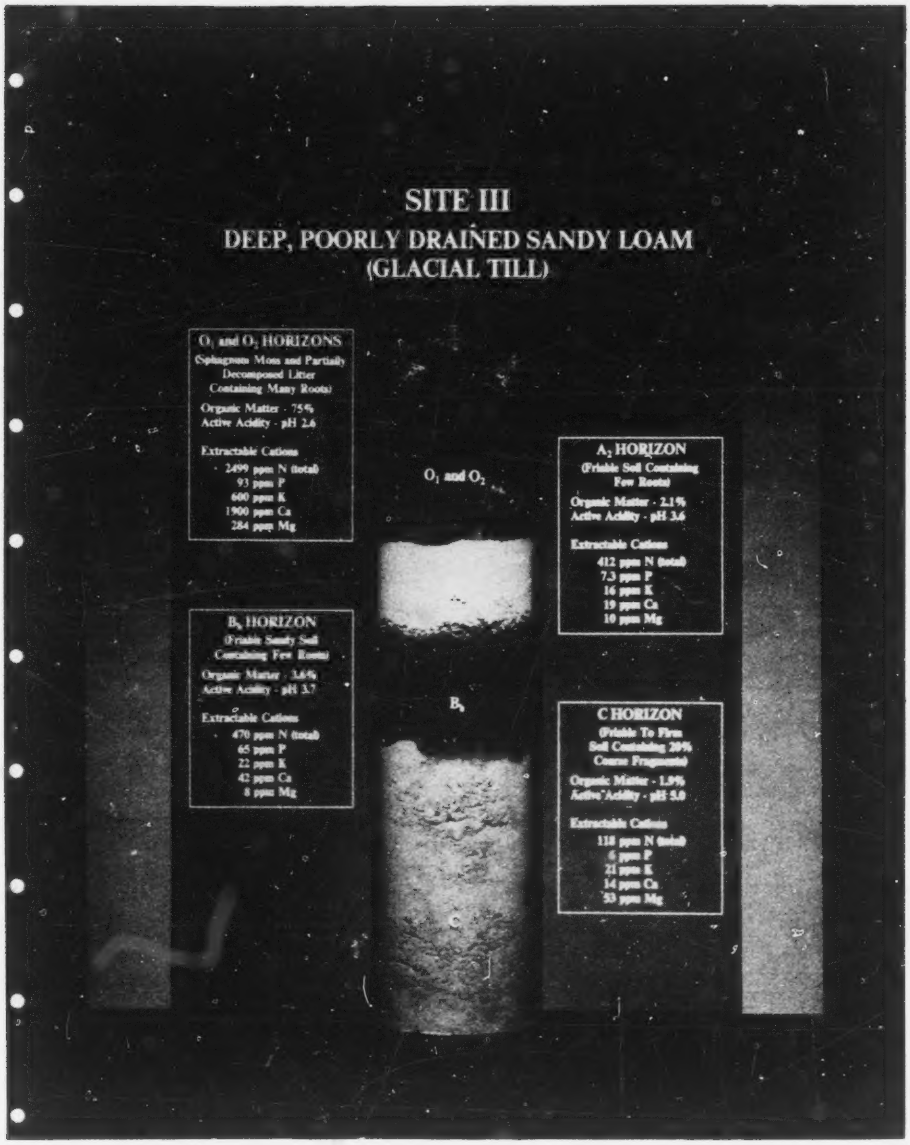
Organic Matter - 15.3%
Active Acidity - pH 3.0

Extractable Cations
176 ppm N (total)
6 ppm P
188 ppm K
15 ppm Ca
44 ppm Mg

B_{22} HORIZON
(Friable Light Soil Containing Few Roots)

Organic Matter - 3.5%
Active Acidity - pH 3.6

Extractable Cations
176 ppm N (total)
228 ppm P
39 ppm K
20 ppm Ca
3 ppm Mg



SITE III

DEEP, POORLY DRAINED SANDY LOAM (GLACIAL TILL)

O_1 and O_2 HORIZONS
(Sphagnum Moss and Partially Decomposed Litter Containing Many Roots)

Organic Matter - 75%
Active Acidity - pH 2.6

Extractable Cations
2499 ppm N (total)
93 ppm P
600 ppm K
1900 ppm Ca
284 ppm Mg

B_h HORIZON
(Friable Sandy Soil Containing Few Roots)

Organic Matter - 3.6%
Active Acidity - pH 3.7

Extractable Cations
470 ppm N (total)
65 ppm P
22 ppm K
42 ppm Ca
8 ppm Mg

A_2 HORIZON
(Friable Soil Containing Few Roots)

Organic Matter - 2.1%
Active Acidity - pH 3.6

Extractable Cations
412 ppm N (total)
7.3 ppm P
16 ppm K
19 ppm Ca
10 ppm Mg

C HORIZON
(Friable To Firm Soil Containing 20% Coarse Fragments)

Organic Matter - 1.9%
Active Acidity - pH 5.0

Extractable Cations
118 ppm N (total)
6 ppm P
21 ppm K
14 ppm Ca
53 ppm Mg

STATEMENT
MINING AND RECLAMATION COUNCIL OF AMERICA
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
FEBRUARY 10, 1984

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, I AM THOMAS ALTMEYER, VICE PRESIDENT FOR CONGRESSIONAL AND GOVERNMENT AFFAIRS OF THE MINING AND RECLAMATION COUNCIL OF AMERICA (MARC). MARC IS A NATIONAL ASSOCIATION OF COAL PRODUCERS AND ALLIED INDUSTRIES REPRESENTING OVER 200 COMPANIES AND 32 STATE AND REGIONAL COAL ASSOCIATIONS. THROUGH ITS CORPORATE MEMBERSHIP AND AFFILIATED ASSOCIATIONS, MARC REPRESENTS OVER 3,000 COAL OPERATORS AND INDUSTRY SUPPLIERS NATIONWIDE. MARC APPRECIATES THE OPPORTUNITY TO PRESENT ITS CONCERNS TO THE COMMITTEE.

IN THE LIMITED TIME AVAILABLE, I WILL REVIEW MARC'S POSITION ON CURRENT LEGISLATION MANDATING REDUCTIONS IN SULFUR DIOXIDE AND NITROUS OXIDE EMISSIONS FROM STATIONARY SOURCES; HIGHLIGHT THE MAJOR CONCERNS RAISED BY VARIOUS PROPOSALS; AND SUGGEST A COURSE OF ACTION FOR THE COMMITTEE'S CONSIDERATION.

ACID RAIN, CONSIDERED BY MANY TO BE ONE OF THE MAJOR ENVIRONMENTAL ISSUES OF THE 1980'S, IS ONE OF THE MORE COMPLEX ENVIRONMENTAL ISSUES TO FACE THE CONGRESS. AS SUCH, IT WOULD BE NAIVE TO THINK THAT SUCH A COMPLEX PROBLEM IS SUBJECT TO A SIMPLISTIC ANSWER. THE COMPLEXITY OF THE PROBLEM IS EXACERBATED BY ITS IMPACT ON NATIONAL ENERGY POLICY, THE POTENTIAL ECONOMIC IMPACT ON REGIONS OF THE COUNTRY, AND POLITICAL CONSIDERATIONS - BOTH DOMESTICALLY AND WITH NEIGHBORING COUNTRIES.

THERE IS, HOWEVER, A BASIC UNDERLYING THEME WHICH, MARC BELIEVES, SHOULD GUIDE CONGRESSIONAL CONSIDERATION OF THIS ISSUE - IT IS THAT A CURE SHOULD NOT BE PRESCRIBED BEFORE THE DISEASE IS UNDERSTOOD. THIS THEME WAS REFLECTED IN THE TESTIMONY OF THE ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY BEFORE THIS COMMITTEE ON FEBRUARY 10. IN ADDITION TO OUTLINING THE SUBSTANTIAL ONGOING RESEARCH EFFORTS TO DEVELOP AN EMPERICAL BASIS FOR PRESCRIBING A CURE, MR. RUCKELSHAUS REVIEWED THE SIGNIFICANT QUESTIONS WHICH MUST BE RESOLVED PRIOR TO INITIATING A MULTI-YEAR, MULTI-BILLION DOLLAR PROGRAM.

WHILE NO AMOUNT OF RESEARCH WILL EVER YIELD ABSOLUTE ANSWERS, SEVERAL ADDITIONAL YEARS OF RESEARCH - BOTH INTO THE PHENOMENON OF ACID RAIN AND ON TECHNOLOGIES FOR MORE COST EFFICIENT REDUCTION OF EMISSIONS FROM COAL COMBUSTION - PROMISE TO PROVIDE A SUBSTANTIALLY ENHANCED INFORMATION BASE UPON WHICH A SOUND POLICY CAN BE BASED. THE MAJOR QUESTION POSED BY THIS APPROACH IS DO WE HAVE TIME TO DEVELOP THAT DATA BASE AND WOULD IT BE IRRESPONSIBLE TO ACT IN ADVANCE OF SUCH KNOWLEDGE.

MARC BELIEVES THE ANSWER IS YES. WHILE I AM NOT A SCIENTIST AND NOT QUALIFIED TO ANALYZE EXISTING RESEARCH, I BELIEVE IT IS REASONABLE TO SAY THAT NEITHER ADVERSE HEALTH EFFECTS NOR ADVERSE EFFECTS ON AGRICULTURE OR FORESTS HAVE BEEN DOCUMENTED AS AN IMPACT OF ACID PRECIPITATION. ALSO SIGNIFICANT IS THE FACT THAT SINCE 1970 SULFUR EMISSIONS FROM STATIONARY SOURCES HAVE BEEN DECREASING APPROXIMATELY 10 PERCENT A YEAR UNDER EXISTING LAW AND THAT, AS OLDER PLANTS ARE REPLACED BY CLEANER ONES, EMISSIONS OF SULFUR DIOXIDE WILL BEGIN TO DECLINE SIGNIFICANTLY STARTING IN THE NEXT DECADE.

It is accepted that high acidity levels exist in waters of sensitive regions of the United States and that these areas do have more acidic rainfall. What is not known is whether a reduction in the level of acidity of rainfall in these areas will result in any corresponding change in the acidity level of the effected waters. As reflected by the National Academy of Science's acid rain study, the relative contribution of local and distant sources of sulfur dioxide and nitrous oxide emissions to the pH level of the rainfall and whether the rainfall directly impacts the acidity level of effected waters is not known.

MARC believes, based upon existing knowledge and projected trends of emissions, that we do have time to develop a better information base prior to deciding whether to initiate a control program and that we do have time to develop more environmentally efficient emission reduction technologies rather than mandating the extremely costly retrofit of existing sources.

For these reasons, MARC is opposed to legislative proposals, either separately or as a part of an amendments package to the Clean Air Act, which would impose multiyear reductions on suflur emissions from stationary sources. MARC is specifically opposed to any federally mandated technology or regulatory requirement on existing sources to reduce sulfur dioxide emissions from stationary sources. MARC believes that the private sector, with its inherent competitive forces, is best equipped to determine the most cost efficient and workable compliance technology to meet emission standards established by the Congress.

Recognizing the problem of acidified waters in sensitive regions of our country and the likely contribution of sulfur emissions MARC supports efforts to expeditiously resolve the scientific uncertainties in our knowledge of the acid rain phenomenon and to immediately address the

PROBLEMS OF ACIDIFICATION OF WATERS IN SENSITIVE REGIONS THROUGH MITIGATION. THESE PRINCIPLES ARE EMBRACED IN LEGISLATION, S.766 AND S.454, INTRODUCED BY THE RANKING MINORITY MEMBER OF THIS COMMITTEE, SENATOR RANDOLPH, AND THE SENATE DEMOCRATIC LEADER, SENATOR BYRD, RESPECTIVELY.

AS REFLECTED ABOVE, MARC BELIEVES THAT GIVEN EXISTING SCIENTIFIC KNOWLEDGE, INITIATION OF A MASSIVE REDUCTION PROGRAM AT THIS TIME IS NEITHER JUSTIFIED NOR SUPPORTABLE. UNDER SEVERAL PROPOSALS BILLIONS OF DOLLARS WOULD BE REQUIRED TO BE EXPENDED WHICH MAY RESULT IN NO IMPROVEMENT TO THE PROBLEMS SOUGHT TO BE ADDRESSED. A MORE PROGRESSIVE COURSE OF ACTION WOULD BE TO ADDRESS THE PROBLEM OF ACIDIFIED WATERS IMMEDIATELY AND TO AGGRESSIVELY MOVE FORWARD WITH A RESEARCH PROGRAM TO DEVELOP AND DEMONSTRATE MORE COST EFFECTIVE METHODS TO REDUCE EMISSIONS FROM STATIONARY SOURCES.

OUR NATIONAL ENERGY POLICY, EVOLVED THROUGH THE DECADE OF THE '70'S, IS PREMISED UPON UTILIZATION OF DOMESTIC RESOURCES, AS COAL, FOR ENERGY PRODUCTION. TO MEET THAT GOAL MARC SUGGESTS THAT INCREASED EMPHASIS MUST BE PLACED ON DEVELOPING PRE-COMBUSTION, COMBUSTION, AND POST-COMBUSTION TECHNOLOGIES THROUGH THE COMMERCIAL DEMONSTRATION STAGE WHICH PERMIT COAL USE FOR POWER GENERATION WITH REDUCED EMISSIONS. THROUGH DEVELOPMENT AND IMPLEMENTATION OF ENHANCED TECHNOLOGIES FOR THE MORE EFFICIENT AND ENVIRONMENTALLY INERT USE OF COAL, COAL CAN CONTINUE TO PROVIDE LOW COST ENERGY FOR AMERICA'S HOMES AND FACTORIES FOR HUNDREDS OF YEARS. THIS COURSE OF ACTION WILL WORK TO SIMULTANEOUSLY PURSUE AND ACHIEVE BOTH OUR NATION'S ENVIRONMENTAL AND ENERGY POLICIES.

National Association of Manufacturers

TESTIMONY

ON BEHALF OF

THE NATIONAL ASSOCIATION OF MANUFACTURERS

PRESENTED BY EDWARD V. SHERRY

DIRECTOR OF ENERGY SUPPLY

AIR PRODUCTS AND CHEMICALS, INC.

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

FEBRUARY 10, 1984

1776 F Street, N.W. • Washington, D.C. 20006 • (202) 626-3700

TESTIMONY
ON BEHALF OF
NATIONAL ASSOCIATION OF MANUFACTURERS

PRESENTED BY EDWARD V. SHERRY
DIRECTOR OF ENERGY SUPPLY
AIR PRODUCTS AND CHEMICALS, INC.

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
FEBRUARY 10, 1984

I am Edward V. Sherry, Director of Energy Supply of Air Products and Chemicals, Inc. and Chairman of the Electricity Task Force of the Energy Committee of the National Association of Manufacturers (NAM). I am accompanied by Mark Griffiths, NAM Assistant Vice President for Resources and Technology.

My testimony today is presented on behalf of NAM, a voluntary association of over 13,000 corporations, large and small, located in every state. Eighty percent of the firms are considered to be small businesses. NAM member companies employ 85 percent of all workers in manufacturing and produce over 80 percent of the nation's manufactured goods. NAM is affiliated with an additional 158,000 businesses through its Associations Council and the National Industrial Council.

My testimony today focuses on NAM's concerns over the effect on electricity costs, domestic employment and the nation's economy of various acid rain proposals. NAM has previously commented to the Administration on the association's concerns regarding other, equally important elements of the acid rain debate. These comments form an appendix to my written statement, which I ask be made a part of the hearing record.

As an association of manufacturers, NAM is well qualified to point out to this Committee that, in choosing an approach to mitigate the problem of acidification of sensitive lakes in the Eastern United States and Canada, you will be making a choice that will have a major effect on the manufacturing segment of our economy. The manufacturing segment employs over 19 million people and is currently operating at approximately 80 percent of capacity with over 8 percent unemployment.

This segment is especially vulnerable to costly new regulations. It is just now recovering from a very deep recession and four years without growth because of foreign competition, adverse foreign exchange rates, high unemployment, low operating rates and restructuring costs.

The ongoing recovery is fragile and in some of the most basic industries, it is not yet apparent. Manufacturers and American labor are struggling to improve their efficiency and productivity, and in so doing, are helping the nation to regain economic growth.

Certainly, the enjoyment of lakes and the preservation of this country's natural environment are important: material goods are not the full measure of Americans' quality of life. For a large number of people, however, the environment most affecting their quality of life is the economic environment in which they live and work. Hopefully, this committee will take these aspects of "environment" into consideration as you deliberate the matters before you.

One of our main concerns with an acid rain control program is its impact on manufacturers' costs to purchase electricity. A recent Lehman Brothers research report on acid rain indicates that various legislative proposals, if implemented, would cause the electric utility industry to expend anywhere from $15 to $40 billion by 1995. This cost burden, which would ultimately be placed on the residential and industrial consumers of electricity, would have a devastating effect on the nation's economy.

To date, the majority of the analyses of the various acid rain proposals relating to their employment effects have centered on lost jobs in the high-sulfur coal mining sector of the workforce. Indeed, one prominent study indicates that the passage of S.768 would lead to the displacement of 172,000 coal mining jobs.

As startling as these numbers might be, they represent just a fraction of the total possible employment effect. What demands a closer look, NAM believes, is the effect of significant electricity rate increases on employment in economic sectors other than coal mining. It is not at all unlikely that industries characterized as heavy consumers of electricity per unit of output may well have no other choice but to relocate offshore, as some are already doing, or cease operations. Either alternative is clearly disadvantageous to the nation's economy and, I submit, to our quality of life.

NAM recommends that this Committee and indeed the Nation follow the course outlined by Administrator Ruckelshaus last week. Specifically, we endorse:

- accelerated funding of research to establish understanding of acid rain and its causes and effects;
- experimental programs in mitigating the effects of acid deposition; and,
- additional research into techniques for reducing emissions.

NAM wishes to thank this Committee for this opportunity to present its views.

NAM
National Association
of Manufacturers

ALEXANDER B. TROWBRIDGE
President

APPENDIX

September 15, 1983

SENT TO ALL
ON ATTACHED LIST

Dear :

We are all concerned about the need to address the problem of acid rain, an issue we understand the Cabinet Council on Natural Resources and the Environment will take up in the near future. The National Association of Manufacturers is especially aware of the environmental and economic consequences of failing to come to grips with this problem in a well-balanced and reasonable manner.

Through various published and unpublished reports, NAM has learned that one of the options that the Cabinet Council will consider contains two fundamentally new provisions: (1) additional sulfur dioxide (SO2) controls for both utility and industrial boilers, and (2) the imposition of an SO2 "cap", using 1980 as a baseline, in a large multi-state region of the country.

We understand that the analysis used by the Environmental Protection Agency to determine the cost of various flue gas desulfurization systems for various sized industrial boilers could be seriously flawed. A recent study by the National Council for Air and Stream Improvement (July 1983) states that EPA's cost estimates "are 40 to 75 percent lower than the capital costs developed in this report for industrial sized boilers with heat inputs from 100 to 400 X 10^6 Btu/hr." NAM urges EPA and the Cabinet Council to closely examine these cost discrepancies before it makes any decision on what, if any, acid rain position the Administration takes.

Of equal concern to the NAM is the notion of an SO2 cap, which NAM believes will have a serious growth-inhibiting effect on many regions of the country. Plant modernization and new plant development could be brought to a virtual halt in those parts of the country where emission offsets are unavailable.

Moreover, many industries in 1980 (the baseline date) were already operating at reduced, recession level capacity, in many cases as low as 50 percent. This cap would lock them in to reduced output and would statutorily idle their unused capacity and make it worthless.

1776 F Street, N.W.
Washington, D.C. 20006
(202) 626-3700

A much more effective approach, especially in this period of awakening economic activity, would be to amend the Clean Air Act to remove its built-in bias against new plants and plant expansion. In this way, older facilities would be phased out more rapidly and be replaced with newer, cleaner facilities. An SO2 cap, on the other hand, would only serve to further the already unacceptable regional disparities and no-growth philosophy implicit in the Clear Air Act.

In addition, we believe that consultation with the industrial community is essential before any final decision is made on acid rain legislation.

Sincerely,

Alexander B. Trowbridge
President

ABT/jmcc

The Honorable Edwin Meese, III
Counselor to the President
The White House
Washington, D.C. 20500
The Honorable James Baker
Chief of Staff and
Assistant to the President
The White House
Washington, D.C. 20500
The Honorable Danny Boggs
Special Assistant to the President
Office of Policy Development
The White House
Washington, D.C. 20500
The Honorable David Stockman
Director
Office of Management and Budget
Executive Office Building
Washington, D.C. 20503
The Honorable Martin J. Feldstein
Chairman
Council of Economic Advisers
Old Executive Office Building
Washington, D.C. 20506
The Honorable John R. Block
Secretary
U.S. Department of Agriculture
200-Administration Building
14th Street & Independence Avenue, S.W.
Washington, D.C. 20250
The Honorable Samuel R. Pierce, Jr.
Secretary
U.S. Department of Housing and
Urban Development
Room 1000
451 Seventh Street, S.W.
Washington, D.C. 20410
The Honorable William French Smith
Attorney General
U.S. Department of Justice
Room 5111
Tenth Street & Constitution Avenue, N.W.
Washington, D.C. 20530
The Honorable George P. Schultz
Secretary
U.S. Department of State
2201 C Street, N.W.
Washington, D.C. 20520
The Honorable Elizabeth H. Dole
Secretary
U.S. Department of Transportation
Room 10200
400 Seventh Street, S.W.
Washington, D.C. 20590

The Honorable A. Alan Hill
Chairman
Council on Environmental Quality
722 Jackson Place, N.W.
Washington, D.C. 20006

William D. Ruckelshaus
Administrator
U. S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Testimony of
John R. Quarles, Chairman
National Environmental Development Association
Clean Air Act Project
before the
Senate Environment and Public Works Committee
February 10, 1984

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to present testimony on behalf of the National Environmental Development Association's Clean Air Act Project (NEDA/CAAP) on proposed amendments to the Clean Air Act. NEDA/CAAP is a coalition of industry and 15 trade unions of the AFL-CIO.

My testimony will focus on a narrow -- but potentially far-reaching -- section of S.768 addressing acid rain. This growing issue is referred to as the "emissions cap" which is contained in S.768 as well as several other acid rain bills. I will not discuss the other Clean Air Act issues which are of interest to NEDA/CAAP. For a discussion of those other issues, I refer you to the comments I presented to this committee on November 17, 1983.

During the past several years the national debate over acid rain has grown. That debate has focused attention on various adverse consequences of acid rain, possible strategies for reducing acid rain, and costs associated with these proposals. S.768 proposes an ambitious national control program designed to reduce emissions of sulfur dioxide from 1980 levels within the 31 eastern states by 8 million tons per year.

We are greatly worried that S.768 and S.769's acid rain provisions in effect place a cap on production, obstructing the use and expansion of our national industrial capacity.

Section 183(c) of the Clean Air Act, as it would be amended by S.768, would provide, with the exception of coal conversions by utility boilers under the Fuel Use Act, that:

> "no major stationary source [within the 31-state region] which began operation before January 1, 1981, shall increase its actual rate of emissions of sulfur dioxide over that experienced by such source during calendar year 1980, unless [the source has complied with offsets requirements]."

This provision and related parts of S.768 establish the so-called "emissions cap" which is intended to prevent any increase in existing emissions.

We have several major concerns with the cap features of this bill. Our main concern is the emissions cap will be a cap on productive capacity and will cause a ripple of severe consequences disrupting normal industrial operations and growth throughout the 31-state region.

There are six principal points which I will make today to illustrate the potential problems with a sulfur dioxide and nitrogen oxide emissions cap. They are:

- Current proposals fundamentally restructure parts of the Clean Air Act.
- An emissions cap will have the effect of restricting full use of existing industrial capacity.
- An emissions cap will restrict the ability of plants to switch fuels.
- An emissions cap will limit new growth.
- An emissions cap provision does not properly integrate with other sections of the Clean Air Act.
- The premise behind the need for an emissions cap is questionable at best -- and erroneous at worst.

It is for these reasons that NEDA/CAAP strongly recommends that an emissions cap not be part of the proposed Clean Air Act Amendments.

I. AN EMISSIONS CAP CHANGES THE BASIS OF THE CLEAN AIR ACT

Limiting emissions to historic and actual levels, as proposed by the emission cap under S.768, will fundamentally restructure how emissions have been permitted and regulated under the Clean Air Act, causing a number of dislocations and problems.

When an applicant applies for a permit, both he and EPA look at the size of the plant, the fuel being used, the production level of the plant, and available emission controls. Generally, it is assumed the plant will operate at its full capacity. EPA issues the applicant a permit which specifies the maximum allowable emissions from the plant based on these factors, recognizing that actual emissions will fluctuate and often be well below allowable levels. Standard permit conditions require that emissions control equipment be operated at all times so a company cannot take advantage of lower production levels to cut back on pollution control.

Under the emissions cap proposal contained in S.768, the permitting system will change from one which depends on the production level at which a plant is designed to operate (as described above), to one based on the production level at which a plant has actually operated over a specified historic period.

This change will have serious, disruptive results which I will now describe.

II. AN EMISSIONS CAP CAN RESTRICT FULL USE OF PRODUCTIVE CAPACITY

The most severe, unfair, and socially disruptive effect of the proposed legislation would occur if it should be applied in a manner to prevent facilities from operating at full capacity, as the language of the proposed section 183(c) suggests. That language states that no source shall increase its "actual rate of emissions" over calendar year 1980 without first acquiring offsets.

The clearest example of a regulatory miscarriage will occur if a facility which was operating only at partial capacity due to lack of demand for its production or because of other factors during the base year is restricted from operating at full capacity under these proposed restrictions. For example, a company operating at 70 percent capacity in the base year would not be able to expand to its full 100 percent production. To use the remaining 30 percent capacity, the company would have to treat the unused part of the plant as a new source under the Clean Air Act and apply for new permits and satisfy offset requirements.

The result would be especially harsh if a plant has laid off workers and is prevented from rehiring them to return to normal operations. In addition, this restriction could interfere with many other types of relatively minor normal operating changes, which may increase emissions over the base year yet remain within allowable limits. In short, the danger that the emissions cap may preclude maximum use of existing industrial capacity must be avoided.

III. AN EMISSIONS CAP WILL INTERFERE WITH FUEL USE

Fuel use is a fundamental component of nearly all major industrial operations. For most industrial plants, on-site fuel combustion represents a substantial operational element having air quality significance, and many such facilities are designed with flexibility to use alternate types and grades of fuel. Thus an industrial plant may have existing equipment and regulatory approval, which permits it to shift between coal and oil or between oil and natural gas, or possibly among all three, in addition to shifting between various grades of fuel with respect to their sulfur content.

It is also of critical importance to recognize that many industrial plants have "interruptible" natural gas supply agreements, and that although they may normally burn natural gas they also are permitted to burn other fuels such as oil. If the gas supplier for any reason cuts off the gas, a user must be able to switch quickly to an alternate fuel, which could result in a slight increase in emissions. If it cannot do so, it may be forced to shut down.

The apparent effect of section 183(c) as set forth in S.768 will be to freeze patterns of fuel use on the basis of 1980 operations. That would deprive numerous industrial facilities of important elements of operating flexibility. It would impose such effects on a rigid and arbitrary basis.

An example of this problem within our membership is a refinery which after two years of environmental monitoring and negotiation received a permit allowing it to burn heavy fuel oil, fuel gas, and natural gas and to emit 0.6 lbs/mmBTU annual average. Because of the current abundant supply of natural gas and fuel gas, actual emissions dropped to 0.2 lbs/mmBTU by 1980. Should supplies of refinery fuel gas or natural gas become limited, the refinery would not be able to return to burning heavy fuel oil if it was subject to an emissions cap based on 1980 levels -- even though the current permit would allow it.

A similar situation exists in another member's chemical plant. If an emissions cap is based on actual SO_2 emissions in 1930, more than 75 percent of the plant's installed capacity will be subject to gas availability and cost. About 2500 workers could lose their jobs if natural gas becomes unavailable and the plant is not able to switch to an alternate fuel.

IV. AN EMISSIONS CAP WILL LIMIT NEW GROWTH

The cap, regardless of whether it is based on actual or permitted emissions, will act as a disincentive to new growth.

It will further complicate the regulatory process for approving construction projects to expand industrial facilities. The acid rain proposals will have the effect of establishing a 31-state nonattainment region in which any new project will require offsets.

If that is the result, we believe the consequences will be extremely unfortunate. Without question, such a policy will severely hurt the economic vitality of the eastern United States. It is hard to imagine this effect is intended or that such an effect could be considered desirable in light of the limited benefit this would have to air quality enhancement.

Experience with the offsets requirements, as they have been in effect under the nonattainment provision of the Clean Air Act since 1977, has been most discouraging. In many instances, companies have succeeded in identifying offsets where they sought to expand an existing facility and could find offsets within that facility itself. By contrast, it has been rare that any company has succeeded in identifying and using off-site offsets. With all of the publicity about offsets trading, and all of the efforts to create banks and markets, few tangible results have been realized. The need to obtain offsets to permit an industrial expansion project presents a formidable obstacle. Experience indicates that if a system of offset requirements is established on a widespread basis, it will severely curtail normal economic development.

It is important to note that this feature, coupled with the other effects, will result in ironic conflicts in the states. States which today have low SO_2 emissions due to extensive natural gas firing will be especially disadvantaged. For example, because of extensive natural gas use, Louisiana has a low pool of SO_2 offsets to draw on, and therefore any new growth involving SO_2 emissions will be difficult, if not impossible.

V. AN EMISSIONS CAP DOES NOT INTEGRATE WELL WITH THE CLEAN AIR ACT

In addition to these problems caused by a cap, there is another serious deficiency with S.768 and with other acid rain proposals: the inability to successfully relate an emissions cap to existing programs of the Clean Air Act. As the most conspicuous example, if an acid rain program is adopted which prevents SO_2 emissions from increasing, clearly PSD increments no longer make sense -- theoretically or practically. PSD is designed to limit "significant" increases in emissions. The acid rain programs which we have seen to date will make it illegal to have "any" increases, let alone insignificant increases.

Sponsors of acid rain proposals, including S.768, must give serious consideration to how the program will relate to other Clean Air Act programs. Failure to do so will subject the regulated community to confusing and contradictory requirements.

V. THE NEED FOR AN EMISSIONS CAP IS QUESTIONABLE

Finally, studies showing increased emissions in the immediate future are faulty.

Supporters of the cap on sulfur emissions base the need for controls on data projecting increases in emissions during the next two decades. According to some studies, the trend for SO_2 emissions is down with the exception of the 1980 to 2000 period which shows an increase in emissions. There have been a number of projections ranging from 1.5 million tons/year to 3 million tons/year. The EPA, in its February '83 report, "Analysis of the Senate Reduction Bill," projects an increase of approximately 1.5 million tons -- 1 million tons from utilities and .5 million tons from industrial sources. It is necessary to realize the forecasted increase is based on expectations of industry increasing use of, and switching to, higher sulfur fuels.

There are two fundamental problems with this projection. The first is the assumption that industry will increase coal use; the second is the degree of accuracy of the emissions inventories on which the projections are based.

We believe the assumptions regarding increased use of coal are substantially overstated. A recent study completed by the Council of Industrial Boiler Owners (CIBO) critiquing EPA's study contrasted EPA coal conversion assumptions with the marketing projections of the boiler manufacturing industry. The result is that EPA and other studies predict a much greater number of coal conversions than those who would benefit economically from conversions. The studies appear to overstate conversions to coal by a factor of five, according to CIBO. This factor alone could substantially overstate the projected increase.

Second, the degree of accuracy of the projections is questionable due to emission inventories. Historical emission inventories are used to assess existing as well as future emissions trends. However, most experts at EPA will admit that due to differences in reporting methods and the accuracy of emissions tracking by the states, the emissions inventories used to make these projections may have an error factor of 10 to 20 percent.

Couple this with the overstated assumption regarding industry coal use and these projections become extremely questionable. Therefore the entire basis for needing an emissions cap may be wrong.

CONCLUSION

An emissions cap will have serious consequences for industry and employment. Under S.768, the Committee proposes choosing a year at the start of the recession and freezing production at the levels of that year. The bill will make it against the law to use 100 percent of installed capacity -- capacity previously approved under the Clean Air Act permitting process. Increased production will be prevented despite the fact that no human health or significant harm has been identified.

Congress will be establishing not only an emissions cap, but also a production cap. The far-reaching consequences of adopting S.768 provisions must be clearly understood from the start.

As I have discussed, the cap will lock some companies into reduced product output, prevent new growth, and limit industry's choice of fuel uses.

It follows that unemployment problems may be widespread. If companies are prevented from operating at full capacity or expanding their plants, they will be unable either to recall employees who were laid off or hire new employees. This effect on employment cannot be overlooked.

Additionally, a cap based on actual emissions is arbitrary and will have inequitable impacts on industry. Choosing an arbitrary year to base an emissions cap will affect industry in different and unequal ways. If the year chosen was a recession year, a large number of indusries will be hurt. But even if the year chosen was a good economic year, some industries probably were not as well off as others, due to cyclical demand for their product and other reasons. The consequence is that all industry -- large companies and small businesses, heavy manufacturing and light manufacturing -- is likely to be treated unevenly and unfairly.

There are also a number of unanswered questions. If 1980 is the base year, how do you treat plants constructed after 1980? How do you treat plants which have been permitted after 1980 which are not built or operating at this time?

The effects of the emissions cap will exponentially increase the number of plants and constituencies regulated under an acid rain program. The initial intention of this Committee was to focus attention only on those limited number of sources where significant reductions of SO_2 can be made. Under an emissions cap, every plant emitting SO_2 will be drawn into the acid rain regulatory program, even if only insignificant amounts of SO_2 are being emitted. Can a program function with such large numbers?

After evaluating these negative consequences of a production cap, the fundamental question remains: "Is it worth it?" Are the cap on production and its substantial costs worth levying controls when the whole premise for a cap is based on data clouded by uncertainty?

Projections on whether or not industrial emissions will increase in the 1990s depend on major assumptions. These include conversions to coal by industry, rate of replacing old plants with new, the role of nuclear power, GNP growth and the need for increased use of existing plants, and others, not to mention assuming the accuracy of emissions data.

Some of these assumptions almost certainly will not hold, such as that of the coal conversion rate. The projected massive switch to coal by industry shows no signs of occurring. Previously it was assumed the number of nuclear power plants would increase substantially; now it seems many plants will never be completed. Each assumption is just that -- precarious at best.

Congress must decide if freezing production at levels from a year characterized by recession, and causing negative impacts on industry and employment is indeed worth the prevention of an increase that most likely will not occur.

FF:0077C

National
League
of
Cities

1301 Pennsylvania Avenue NW
Washington, D.C.
20004
(202) 626-3000
Cable: NLCITIES

Officers

President
George Latimer
Mayor, St. Paul, Minnesota

First Vice President
George V. Voinovich
Mayor, Cleveland, Ohio

Second Vice President
Carol Bellamy
Council President, New York, New York

Immediate Past President
Charles Royer
Mayor, Seattle, Washington

Executive Director
Alan Beals

STATEMENT OF

THOMAS WHITE, COUNCILMEMBER

GREENBELT, MARYLAND

on behalf of

THE NATIONAL LEAGUE OF CITIES

on

ACID RAIN

before the

Committee on Environment and Public Work

United States Senate

February 10, 1984

Past Presidents: **Tom Bradley,** Mayor, Los Angeles, California • **Ferd L. Harrison,** Mayor, Scotland Neck, North Carolina • **William H. Hudnut, III,** Mayor, Indianapolis, Indiana • **Henry W. Maier,** Mayor, Milwaukee, Wisconsin • **Jessie M. Rattley,** Councilwoman, Newport News, Virginia • **John P. Rousakis,** Mayor, Savannah, Georgia • ***Directors:*** **John B. Andrews,** Executive Director, New Hampshire Municipal Association • **Arden Ashley,** Mayor, Nitro, West Virginia • **Marion S. Barry, Jr.,** Mayor, Washington, D.C. • **Robert R. Cantine,** Executive Director, Wyoming Association of Municipalities • **Henry Cook,** Council President, Jacksonville, Florida • **Joe W. Davis,** Mayor, Huntsville, Alabama • **John P. Franklin,** Vice Mayor, Chattanooga, Tennessee • **William F. Fulginiti,** Executive Director, New Mexico Municipal League • **George D. Goodman,** Director, Michigan Municipal League • **Edwin L. Griffin, Jr.,** Executive Director, Kentucky Municipal League • **Daniel E. Griset,** Vice Mayor, Santa Ana, California • **Richard Guthman, Jr.,** Council Member, Atlanta, Georgia • **Charlee Hoyt,** Alderman, Minneapolis, Minnesota • **Delores Hudson,** Councilwoman, Warrensburg, Missouri • **Robert M. Isaac,** Mayor, Colorado Springs, Colorado • **Luther G. Jones, Jr.,** Mayor, Corpus Christi, Texas • **Peter C. Knudson,** Mayor, Brigham City, Utah • **Dud Lastrapes,** Mayor, Lafayette, Louisiana • **Ted Lehne,** Council Member, Fairbanks, Alaska • **Paul A. Lenz,** Mayor, Alton, Illinois • **E. A. Mosher,** Executive Director, League of Kansas Municipalities • **Brian J. O'Neill,** Council Member, Philadelphia, Pennsylvania • **Pamela P. Plumb,** Councilor, Portland, Maine • **Elaine Szymoniak,** Council Member, Des Moines, Iowa • **Consuela S. Thompson,** Mayor, Espanola, New Mexico • **Donald Tucker,** Council Member, Newark, New Jersey • **Joseph W. Walsh,** Mayor, Warwick, Rhode Island • **Iola M. Williams,** Councilwoman, San Jose, California • **Thomas D. Wingard,** Mayor, Greenwood, South Carolina • **Louis Zapata,** Council Member, Fort Worth, Texas

STATEMENT OF
THOMAS WHITE, COUNCILMEMBER
GREENBELT, MARYLAND
FOR THE
NATIONAL LEAGUE OF CITIES
FEBRUARY 10, 1984

Mr. Chairman and members of the Committee. I am Thomas White, Councilmember from Greenbelt, Maryland and Chairman of the National League of Cities' Energy, Environment and Natural Resources Committee. I am here today on behalf of the National League of Cities which represents 15,000 cities in every part of the nation to testify on a control strategy for air pollutant emissions responsible for acid rain.

The city officials who comprise the National League of Cities have spent considerable time on the issue of acid deposition. There were three opportunities at our recent annual meeting, where the NLC membership had an opportunity to discuss and vote on the recommendations of the Energy, Environment and Natural Resources Steering Committee. I can say that every viewpoint was considered, that proponents of a particular control strategy had more than one opportunity to convince their colleagues of the rightness of their position, and that at each step of the policy development process the vote was overwhelmingly in favor of the Steering Committee's recommendation. That recommendation is now official policy of the National League of Cities and is attached to my testimony for your perusal.

The National League of Cities recommends that:

1. Congress should enact a program to reduce substantially sulfur dioxide and nitrous oxide emissions over a long-term period.

While not scientists ourselves, we believe there is sufficient scientific evidence, including reports from the National Academy of Science and the White House Office of Science and Technology Policy, linking sulfur dioxide and nitrous oxide emissions to acid deposition to justify the development of a control strategy now. Furthermore, to obtain scientific data that assures beyond a shadow of a doubt the link between emissions and acid rain will take decades. We are concerned that if nothing is done in the interim, the potential for irreversible damage is real, and that the damage will become even more widespread.

By "substantial reductions" over a "long-term period" we mean an 8 to 12 million ton reduction of SO_2 and NO_x emissions over a ten to fifteen year period.

2. The federal government should require any increases in sulfur and nitrogen oxide emissions be simultaneously offset by reductions from other existing sources of these pollutants.

It is not our intent, by recommending a control strategy to inhibit new industrial growth and development. We do believe, however, that it is essential to insure that such growth does not result in increased pollution.

3. Congress should develop a specific mechanism to distribute the burden of compliance costs to temper disproportionate rate increases and to mitigate the adverse impacts of the requirements on employment.

Needless to add, we are also concerned about the cost of implementing a control strategy -- not only in dollar terms for those facilities that will be required to install costly equipment to reduce emissions, but also for the consumers of electricity generated by fossil fuel fired plants and the miners of high sulfur coal as well.

We recommend control strategies which would avoid enormous dislocations, job losses among miners, and huge increases in electricity bills in areas that are already experiencing high unemployment and economic distress.

4. Compliance should be funded through revenues raised by imposing a fee on fossil fuel electricity generation within the 48 contiguous states, exempting those facilities meeting new source performance standards.

It is increasingly evident that acid rain is not a problem exclusive to the northeastern part of the United States. It is becoming a problem west of the Mississippi as well. Further, it is our position that clean air is in the national interest and therefore all polluters, regardless of their geographic location or the extent of acid deposition in their area, should be responsible for a share of the compliance costs. Other programs, such as the development of water resources and agricultural subsidies, have been funded with federal tax receipts and have resulted primarily in regional benefits. We see no reason why a similar federal commitment to clean air should not also be regarded as an appropriate national responsibility.

As a matter of equity, those facilities which have already invested in costly control strategies and are meeting new source performance standards should not be required to pay twice. Sources which are not contributing to the problem, such as hydro and nuclear generation plants, should also not be required to participate financially.

5. Funds generated by user fees should be used to finance the capital costs of whatever technology-based control methods are deemed appropriate by affected utilities.

Revenues generated from a tax on polluters should be designated solely for distribution among the facilities required to control emissions, thus helping to defray the costs of purchasing and installing controls. We do not believe Congress should mandate a specific technology, but should leave that decision to the affected utilities. We do not think coal switching, will inevitably be the technology of choice. We believe the reductions called for in our policy, cannot be attained by coal switching.

6. Congress should direct EPA to increase research and demonstration into new and less expensive technologies for reducing sulfur and nitrogen oxides, and to develop economic uses for by-products of pollution control technologies.

The Administration's recommendation for substantial increases in funding for acid rain research activities -- while laudable -- is, by itself, an inadequate response to the problem. We believe more intensive activity in this area is essential and that Congress should approve EPA's budget request as one part of an overall strategy to reduce acid deposition.

7. The federal government should recognize the offer of the Government of Canada for a bilateral 50 percent reduction in sulfur dioxide emissions and should conclude negotiations and adopt a treaty committing both countries to this goal.

We recognize the transboundary nature of acid rain and believe that solutions to the problem transcend the jurisdiction of any one government or level of government -- national, state or local. It is recognized that the United States is not the source of all sulfur and nitrous oxide emissions, but that Canadian facilities contribute to the pollution problem as well. We believe it is in the interest of both countries to work cooperatively for our mutual benefit.

Thank you, Mr. Chairman, for the opportunity to present our views on acid rain. We look forward to working with you to develop an effective remedy to this increasingly costly problem.

NATIONAL LEAGUE OF CITIES

POLICY STATEMENT

11. Acid Deposition

Congress and the Administration should recognize that the transboundary nature of acid deposition calls for solutions that transcend the jurisdiction of any one local or state government. Specifically, the following actions should be taken:

a. Congress should enact a program to substantially reduce sulfur dioxide emissions and nitrous oxide emissions over a long-term period in order to facilitate the implementation of technology which achieves the highest emissions reductions.

b. The federal government should require that any increases in sulfur and nitrogen oxide emissions be simultaneously offset with reductions from other existing sources.

c. Congress should develop a specific mechanism to distribute a portion of compliance costs for the purpose of tempering disproportionate rate increases and mitigating the adverse impacts of the requirements on employment. NLC recommends that costs be redistributed by funding the compliance program through a user fee on all electricity generation within the 48 contiguous states. The resulting funds would be used to finance the capital costs of whatever technology-based control methods are deemed appropriate by the affected utility. Electricity generated from hydroelectric power plants, nuclear power plants, and electric utility plants currently in compliance with new source performance standards would be exempted from the user fee requirement.

d. The federal government should recognize the offer of the government of Canada for a bilateral 50 percent reduction in sulfur dioxide emissions and should conclude negotiations and adopt a treaty committing both countries to this goal.

e. Congress should direct EPA to increase research and demonstration of new, less expensive technologies for reducing sulfur and nitrogen oxides, and to develop economic uses for by-products of pollution control technologies.

THE CITIZENS' TASK FORCE ON ACID RAIN
c/o NHACC
54 Portsmouth Street
Concord, NH 03301

Statement of

Jacquelyn L. Tuxill
Chairperson

N.H. Citizens' Task Force on Acid Rain

Before the

Committee on Environment and Public Works
U.S. Senate
February 10, 1984

Mr. Chairman, members of the committee, thank you for the opportunity to present testimony on the subject of acid rain and the control proposals before the committee.

EPA Administrator William Ruckelshaus has called acid rain one of the most regionally divisive issues he has ever encountered. Let me open my remarks today by saying that the Reagan Administration's position of more study and no action is the most divisive course we could follow on acid rain. It is also regressive. The people of this country have put divisiveness behind them and are actively seeking solutions to the acid rain problem, not denials and inaction.

The citizens' conference, ACID RAIN '84, held in Manchester, N.H. one month ago is illustrative of this fact. Nearly 700 people from all across the country and Canada, 150 of them representing the media, gathered together seeking remedies and action on acid rain. Coal miners from Kentucky sat down with sportsmen from New England. Representatives of the food products industry mingled with

Representing: Audubon Society of New Hampshire • Harris Center for Conservation Education • Loon Preservation Committee • New Hampshire Association of Conservation Commissions • New Hampshire Lung Association • New Hampshire Science Teachers Association • New Hampshire Wildlife Federation • Society for the Protection of New Hampshire Forests • Trout Unlimited • League of Woman Voters • Lake Sunapee Protective Association • Appalachian Mountain Club • Connecticut River Water Shed Council • Monadnock Sierra Club • Salmon Unlimited and citizens concerned about acid rain people concerned with public health effects of acid rain. Labor interests, educators, public officials, native Americans, legislators, scientists, and environmentalists from the midwest, the south, the northeast, the southwest and the far west -- all committed to solving the problem together -- listened to scientists talk of the urgent need to control acid rain, heard of growing evidence of acid rain damage in the midwest and Appalachia, discussed with experts the control options available, the costs, the impact on jobs. After two days there was not divisiveness and denials, but unanimous agreement and a shared commitment to doing what is fair. A citizens platform calling for a 50% reduction in sulfur emissions nationwide by 1990 was unanimously adopted, as was a U.S./Canada citizens agreement calling on both countries to commit themselves to the 50% SO_2 reduction goal. Copies of both documents are attached.

I am here today to say to you as strongly as I can that the people of this country will and do support an acid rain control program. Americans have a fundamental sense of fairness, they care about the integrity of their environment and natural resources, and they believe in the basic right to breathe clean air and drink clean water.

Pollster Louis Harris has tapped into this deep vein of concern. In a speech before the Coalition of Northeastern Governors on December 4, 1983, Mr. Harris relayed the following results relating to acid rain:

- By an 86-12% margin, Americans want to keep the Clean Air Act intact or make it stricter.
- By 65-32%, Americans oppose relaxing standards on the basis of the cost of cleaning up air pollution that endangers human health.
- Today 63% of Americans are familiar with acid rain, up from 55% in 1982, 43% in 1981, and 30% in 1980.
- By 73-22%, Americans feel it is fair that the costs of cleaning up acid rain should be borne by all individuals and businesses who use fuels that contribute to the problem. Regional sentiments on this cost-sharing question were essentially all in the same range.

* By 60-35%, respondents feel acid rain cleanup costs should be paid by electricity customers nationally.

Other indications of public support for an acid rain control program include:

1. New Hampshire Town Meeting Vote; Cities follow

In March 1983, at 197 town meetings across New Hampshire, town residents voted overwhelmingly for a resolution asking Congress to pass an acid rain control program that requires a 50% reduction in SO_2 emissions by 1990. Over the past year all of New Hampshire's 13 cities have passed by city council vote the same resolution. Altogether these votes represent the sentiments of 95% of New Hampshire's population.

2. Citizens Hearings

In the past six months citizen hearings on acid rain were held in three cities to present information on acid rain damage in the affected states. The cities were Pittsburgh, Pa. (7/7/83); Philadelphia, Pa. (7/7/83); and Jacksonville, Fla. (11/17/83). State damage reports were compiled and presented to the respective state Congressional delegations by the citizens. In all instances the hearings were packed with standing room only. The Pennsylvania hearings had over 200 citizens at each hearing, while the Florida hearing attracted over 250.

3. State Public Opinion Polls

In October 1982, the Carolina Poll, under the auspices of the University of North Carolina School of Journalism, conducted a survey of 584 North Carolina residents on the subject of acid rain. By a 4-1 margin respondents regarded acid rain as a serious or very serious problem, and were nearly unanimous in their support for tighter controls on power plant emissions. Of those supporting tighter controls, 83% would continue to do so even if it meant a modest increase in their utility bills.

A Minnesota poll in January, 1984 by the St. Paul Pioneer Press/ Dispatch found that 94% of those polled believed acid rain to be a serious matter, and 68% felt that acid rain should be controlled at the national level. In a New York public opinion poll carried out by the N.Y. Cooperative Extension and Cornell University, 80% of the respondents agreed that "there is no doubt that the threat of acid rain exists and there is a need for action now."

4. Other examples of citizen initiatives in the acid rain issue include citizen monitoring programs organized in New Hampshire, Vermont, Massachusetts, and Minnesota; the TV Acid Rain Index, begun in Maine and spreading to other states; and state SO_2 control legislation initiated and supported by citizens in Minnesota. Other states have held public hearings on state bills and legislative resolutions regarding acid rain.

To comment more specifically on legislative proposals, none of the bills currently before the committee meet what we feel are the minimum requirements for an effective acid rain control program. While S.769 does call for a 12 million ton reduction in SO_2 emissions, the program is not national in scope and it fails to address the crucial issue of job protection.

We feel the following elements are essential to an effective acid rain control program:

1. The SO_2 reduction must be 50% at a minimum.

The National Academy of Sciences (NAS) in 1981 concluded that a 50% reduction in deposited hydrogen ions was necessary to "significantly reduce the rate of deterioration of sensitive freshwater ecosystems." Similarly, the January 1983 Canadian Summary of the U.S. Canada Working Group proposed that wet sulfate deposition be reduced to "less than 20 kg./hectar/yr. in order to protect all but the most sensitive aquatic ecosystems." In New Hampshire this translates into slightly more than a 50% reduction in sulfur loading.

Let us not lose sight of the fact, however, that even with a 50% SO_2 reduction, precipitation in the northeast will still be acid. The 50% figure is not a magic threshold between damage and no damage. It should reduce acidity levels, though, to the point (greater than pH 4.5) where aquatic ecosystems can support fish life.

If a control program of less than 50% SO_2 reduction is passed, the damage process may be slowed some, but the end result will be the same. We in New Hampshire, who regularly experience some of the most acidic precipitation in the country, feel most strongly that 50% SO_2 reduction is the absolute, non-negotiable minimum.

2. The acid rain control program must be national in scope.

Two years ago when the Senate was wrestling with this issue the main areas of recognized damage were the upper midwest and the northeast. As more research has been done, more people brought into the decision-making process, and the solutions thought through in greater depth, it has become increasingly clear that acid rain is a problem national and international in scope. Because of the regional inequities, international implications, the potential for economic dislocations inherent in the fuel-switching debate, and the growing evidence of acid rain damage in areas other than the northeast, the solution must be national in scope and it must come now.

Many of these sub-issues are admittedly thorny; they are, however, definitely solvable. The Acid Rain Task Force of the National Governors' Association (NGA) has tackled the issue and recommended a national program involving significant SO_2 reductions. The NGA's executive committee is currently circulating a proposal for 10 million ton SO_2 reduction. Endorsements for acid rain control have also come from the Coalition of Northeastern Governors, the New England Governors Conference, the Western Governors Policy Office, State and Territorial Air Pollution Program Administrators, and the National League of Cities.

3. Any cost-sharing program incorporated into acid rain legislation must be tightly coupled with the 50% SO_2 reduction target.

While the Senate does not currently have a bill incorporating cost sharing, the concept is worth discussing. We in New Hampshire do not want to pay into a program that will not be effective in the long run in controlling the acid rain damage we're experiencing. We would essentially be paying others to despoil our resources. In the interest of arriving at a solution to the problem, however, we are willing to consider a cost-sharing program that requires a 50% SO_2 reduction nationwide and takes into account past SO_2 cleanup efforts under the CAA, and current contributions to total sulfur emissions. The cost-sharing proposal in HR4404, introduced into the House last November by Rep. Norman D'Amours is worth your consideration in this respect.

The stage is set for action. The scientific evidence to justify immediate control of acid rain is there. The support of the citizens of this country for a fair and equitable acid rain control program is there and the commitment will continue to grow, I can assure you. But the leadership from the Reagan Administration is not there.

This committee and Congress as a whole has a clear choice. You can backpedal down the administration's research-only road of denial and divisiveness, or you can seize the baton being handed to you by the people and the governors of this country. I respectfully but most strongly urge you to act now to effectively control acid rain.

Thank you.

The N.H. Citizens' Task Force on Acid Rain is a coalition of conservation, public health, educational, and sportsmen's groups in New Hampshire, as well as individual citizens concerned about acid rain.

Since 1980 the Task Force has worked to increase public awareness of the acid rain problem and encourage citizen participation in a legislative solution.

ACID RAIN '84

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New Hampshire Natural Resources Forum

Sierra Club

Society for the Protection of New Hampshire Forests

Vermont Clean Air Coalition

UNITED STATES/CANADA
CITIZENS AGREEMENT

Air pollution and associated acid rain is causing extensive damage to the environment and the health of citizens in the United States and Canada. Without immediate action to stop acid rain, irreversible damage will continue with severe consequences to human health and the economies of both countries.

Presently, both countries emit sulfur dioxide pollution, some of which travels across the border and contributes to the other nation's problems. Consequently, to stop acid rain, the U.S. and Canada must take cooperative action.

The citizens of the United States and Canada therefore urgently call upon our respective governments to establish a joint United States/Canada Acid Rain Control Program which will:

1. Commit each country to reduce sulfur dioxide emissions by 50% toward reducing wet sulfate deposition to less than 18 lbs/acre/year (20 kilograms/hectare/year) in moderately sensitive areas and 8 lbs/acre/year (9 kilograms/hectare/year) in extremely sensitive areas

2. Implement acid rain control strategies to achieve this objective by 1990 with significant interim reductions

3. Establish a mechanism to insure compliance with the stated goals and objectives of the Acid Rain Control Program.

***

ACID
RAIN
'84

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New Hampshire Natural Resources Forum

Sierra Club

Society for the Protection of New Hampshire Forests

Vermont Clean Air Coalition

CITIZENS PLATFORM

Air pollution and associated acid rain are national problems which are causing extensive damage to our environment. Without immediate action to stop acid rain, this damage will continue with severe consequences to the natural resources, public health and economy of our nation.

Solutions to the acid rain problem must be initiated by the federal government. Congress has tried but failed to pass a law which would stop acid rain. President Reagan has failed to provide leadership in solving the problem.

The citizens of the United States urgently call upon the President and Congress to establish early this year, an Acid Rain Control Program which provides for the following:

1. A commitment to reduce sulfur dioxide emissions nationwide by 50% by 1990 toward reducing wet sulfate deposition to less than 18 lbs/acre/year (20 kilograms/hectare/year) in moderately sensitive areas and 8 lbs/acre/year (9 kilograms/hectare/year) in extremely sensitive areas

2. Significant interim reductions in sulfur dioxide emissions

3. Further reductions in nitrogen oxides emissions by 1990

4. Acid rain control accomplished without extensive economic disruption. Proven and environmentally sound technologies to control acid rain are available now. Control techniques that both preserve existing jobs and create new ones can and should be applied.

5. Measures to protect sensitive but still healthy ecosystems to prevent degradation from increases in acid pollution

6. Establishment with the Canadian Government of a joint United States/Canada Acid Rain Control Program to achieve these objectives

***

ACID
RAIN
'84

A Citizens' Conference To Stop Acid Rain

54 Portsmouth St., Concord, NH 03301
(603) 225-4155

ADDENDUM TO CITIZENS PLATFORM

Additional comments were developed by the regional caucuses and are hereby included, as an addendum, to the Citizens' Platform:

1. We believe that conservation and renewable enerby technologies should be vigorously pursued as both short-term and long-term solutions to air pollution problems.

2. Acid deposition reductions are to be 50% of 1980 actual annual emissions.

3. Reductions in nitrogen oxides emissions must be addressed in the same level of detail as sulfur emissions. In particular, nitrogen oxides should be added as a substance limited by increments under the PSD program and nitrogen oxides emissions from light and heavy trucks should be limited.

4. Amend the PSD program to link sulfur dioxide and nitrogen oxides emissions with pH changes in watersheds. Drops in pH below the standards set forth in the Clean Water Act should be prohibited.

5. The existing schedule for control of sulfur dioxide emissions from copper smelters in the southwest should be retained and strengthened.

6. The Clean Air Act should be strengthened to insure that one state is prevented from emitting air pollution which could endanger the public health or welfare in another state regardless of violations of ambient air standards.

7. A bilateral agreement must be reached with Mexico to control sulfur dioxide emissions that will have transboundary impacts.

8. We wish to express a positive approach toward solving the acid rain problem. We, as citizens, offer our continued energy and commitment toward this goal.

9. Our goal is an environment that is clean, safe and sustainable for everyone. Our intent is to insure that the principles of the Acid Rain Control Program are carried out in an environmentally sound manner. Implementation of specific technologies must be consistent with this goal.

***

SPONSORS

Friends of the Earth Foundation

New Hampshire Citizens' Task Force on Acid Rain

COSPONSORS

Acid Rain Foundation

Appalachian Mountain Club

Appalachian Mountain Club New Hampshire Chapter

Audubon Society of New Hampshire

Defenders of Wildlife

Massachusetts Audubon Society

National Clean Air Coalition

National Wildlife Federation

Natural Resources Defense Council

New Hampshire Natural Resources Forum

Sierra Club

Society for the Protection of New Hampshire Forests

Vermont Clean Air Coalition

STATEMENT OF
KURT D. ANDERSON

BEFORE THE SENATE COMMITTEE
ON ENVIRONMENT AND PUBLIC WORKS

February 10, 1984

Committee Members, Ladies and Gentlemen:

My name is Kurt D. Anderson. I am the Environmental Affairs Manager for the New York Power Pool, the eight members of which supply 99 percent of the electric energy used by industry, commerce, and the residents of New York State.

The essence of my testimony is that today your committee does not possess informed studies on the environmental effectiveness of additional reductions of sulfur emissions from power plants. Before enacting a proposal that will result in increased electricity costs by up to $700 million annually in New York State, your committee should ascertain the nature and extent of the alleged environmental damage and come to grips with the most reasonable, effective, and economical method that can be legislated to decrease the impact, *if* the results show they are significant. Since §182 includes this approach, we support this section. However, we are concerned that the remaining provisions of Part E will not result in demonstrable environmental benefits; and while we are finding out that is the case, hundreds of millions of dollars will be added to the cost of a basic energy source so needed by our economy--electricity.

Increasing the cost of electricity in New York through the use of low-sulfur fuels or sulfur removal equipment poses very serious public policy issues:

1. Will the environment be significantly improved?
2. What is the cost to the public?

The scientific community that is studying the environmental impacts and causative mechanisms of acid precipitation has recently developed a consensus which calls into question many of the assumptions stated in §180 of the bill. We believe the causes and effects of acid precipitation are not understood sufficiently to make informed policy judgments at this time. Hence, we support §182 and not the other provisions of Part E.

The New York companies actively support national environmental research through the Electric Power Research Institute, and also support a $4 million/year local environmental research effort through the not-for-profit Empire State Electric Energy Research Corporation. It is through the latter organization that the New York companies conduct research on environmental issues of particular interest to New York State. Acid precipitation research takes up a very large portion of our environmental research budget.

Broad reviews of the present scientific understanding of the causes and effects of acid rain done by the National Academy of Science, EPA, and others cite the lack of information to make firm conclusions on the effectiveness of control measures. Scientists actively engaged in acid precipitation research are not able to support the wide-scale "death and destruction" allegations of the more extreme proponents of the legislation. Neither can they support the theory that acidification is accelerating; there is time for research before legislative action.

Scientific investigation indicates that the impacts of the acidity in rainfall on our croplands is minimal, especially when compared to normal fertilization practices, which commonly contain acidifying chemicals such as nitrates and sulfates. Scientists also note that although adverse impacts of acidity on some forests have been hypothesized, studies to date have not demonstrated this to be the case. What is often overlooked is that acids from the atmosphere supply some of the nutrients necessary for healthy tree growth.

There have been recent attempts to justify acid rain legislation on public health grounds. This has been based solely on speculation, not on scientific evidence. At most, as the Interagency Task Force on Acid Precipitation notes, there are theoretical mechanisms for health impacts, but there is no evidence that such impacts occur. Impacts on structures and out-door art have also been noted. The available information tends to show that acidity in precipitation plays a minor role. The major impacts on materials result from freeze-thaw cycles and chemical attack from other sources such as road salting, corrosive sea spray, and local low level air pollution sources. However, the effects of air pollutants have diminished since the attainment of ambient air quality standards in most areas.

Another issue recently cited in the controversy is the long range versus local source impact issue. New York has decreased sulfur emissions by 50 percent, which should have had a demonstrable affect if local sources are serious impactors on water quality. Yet, studies by the United States Geological Survey, that measured the pH of various watersheds in New York State since the mid-1960's, detected no significant change in the pH of these watersheds over the same time period. Obviously, more study is needed before this issue is understood; but in any case, a decade of high quality scientific measurement of rainfall shows that its acidity is neither increasing nor decreasing. No pH trends can be shown in precipitation or water, even though the Clean Air Act has caused a significant reduction in sulfur emissions.

This then leaves the issue of acid precipitation impacts on our aquatic environment, another area of substantial disagreement. The Adirondacks are usually asserted to be an area of high impact from acid deposition. The Adirondacks have approximately 2,750 lakes and ponds. The media reports widespread destruction of these lakes while, in fact, only about one-third of those lakes and ponds have been chemically sampled, and even that sampling is of rudimentary character. Results of this sampling show that the extent of acidification is small. Less than five percent of the lake acres in the Adirondacks have acidity levels classified as critical. I might note that many of those lakes that are classified as critical (e.g., having a pH of less than five) are commonly called "dead" by the media. However, many of these "dead" lakes do have fish in them. Some of the acidified Adirondack lakes have depressed pH levels due to naturally-occurring physical and hydrological factors. Recent findings suggest that other chemical factors may be limiting fish populations. I bring this to your attention since much of the debate revolves around the alleged impacts of acid rain. I use the term "alleged" because we have not yet defined either the nature or extent of aquatic impacts. It seems reasonable that a better understanding of the magnitude of the problem is necessary before effective action can be taken. Understanding and defining the problem before proceeding with a solution is a basic precept of science, technology, and public policymaking. In keeping with this precept, the New York electric systems will continue to be active participants along with the State of New York in gathering the facts needed for informed decision-making.

As recently announced by Governor Cuomo, the New York State Department of Environmental Conservation and the electric utilities are jointly funding a $4 million effort that will measure the chemical quality and define the fish populations in ~~1,200~~ of the Adirondack lakes over the next three years.

We have already determined from limited detailed scientific studies over the last three to five years in the Adirondacks that each watershed and lake or pond within that watershed is unique. The chemistry of the two score lakes that have been extensively studied shows wide variations due to the minerology of the soils, the hydraulic characteristics of the watershed, and the types of forest cover. Additional work is needed before generalizations can be made as to the susceptibility of certain waterbodies to acidification processes. Scientists have shown that adjacent lakes separated only by a hill can have completely different characteristics and differences in acidity range by a factor of approximately 50 over a distance of one mile. This suggests that indigenous factors can be far more significant than acid deposition.

The New York Power Pool's members are the State's seven investor-owned electric utilities and the New York Power Authority. The electric utilities of New York State have taken a very active role in environmental protection, especially in reducing emissions of sulfur to the atmosphere. In fact, the state's 50-percent reduction of sulfur emissions was achieved by 1980; and in New York City, there was a 90-percent reduction.

New York State is a leader in maintaining a high level of environmental quality. This has been achieved through a cooperative effort between the government of New York State and the industries in the state. The people of the state have voted billions of dollars in bond issues to improve environmental quality, and industry has spent billions of dollars to achieve the same goal. In fact, the electric utility industry alone has spent well over a billion dollars in sulfur dioxide control.

Southeastern New York, where approximately 70 percent of New York's population resides, is supplied in great part with electricity generated from costly 0.3 percent sulfur oil, the cleanest residual oil available for electric power production. The four electric companies serving southeastern New York are among the companies with the highest electric rates in the Nation.

The high cost of electricity is a major concern to consumers, business, and industry throughout New York State, especially regarding jobs and job development. Additional costs that would have to be borne as a result of the proposed bills addressing acid precipitation would further increase the cost of doing business and be antithetic to economic recovery and expansion in this state.

Possibly hard hit by even small increases in the cost of doing business are mature, marginally profitable industries, especially those facing international competition. These industries are many times the major employer in the area, and the loss of jobs if such an industry closes its doors has a multiplier effect in the region. Examples of such industries in New York State are paper, cement, and metalworking. In some cases, the costs of additional acid rain controls may equal or exceed the profit margin of the company.

Most of the acid rain bills being considered would require emissions of sulfur dioxide to be reduced ("rolled back") from a 1980 bench mark. Since New York had already achieved a 50-percent reduction in emissions by 1980, further reductions from that bench mark will be considerably more difficult and expensive in New York than in other states where SO_2 emission rates are much higher. New York's fossil-fired utility boilers emit, as an average, only 1.4 lbs. of SO_2 per million BTU's of heat input. Other states in the Acid Deposition Impact Region, such as Ohio, emit 3 times this average. By not giving credit for pre-1980 reductions, the bills would actually penalize the people of New York for their pre-1980 achievements.

The member systems of the New York Power Pool have estimated that the reductions proposed under S. 768 would result in increased costs for electricity in New York State between $120-700 million per year (in current dollars). The wide range of these increased cost estimates reflects the uncertainty of the cost of fuels, as well as how the state may elect to allocate the SO_2 reductions, assuming the state has the flexibility to make such allocations.

Strategies to achieve reductions could be either to purchase low-sulfur fuel or to install flue gas desulfurization (FGD) equipment. Present FGD systems produce large amounts of sludge--which must be disposed of on land. Also, some generating units do not have sufficient space to install FGD units. Implementing S. 768 may require that FGD be installed at some generating stations, but the bill does not preempt state and local landfill siting laws. Experience suggests that retrofitting of FGD installations will be seriously delayed by local litigation over siting of sludge disposal landfills. Without preemptive federal landfill siting provisions, the bill's 1995 deadline may be difficult or impossible to meet.

Studies by the New York Power Pool conclude that one means of achieving SO_2 reductions would be to increase the use of low-sulfur oil in the state. We are particularly concerned, however, that acid rain legislation would then equate to increased imports of oil, even though federal and state policy is to reduce oil dependence. Our generating capacity in New York State is heavily dependent on oil, since 59 percent of our present installed capacity burns oil.

Because of our concern over additional costs to consumers and resulting possible job losses, because of our record in significantly reducing SO_2 emissions in New York State, and because of our active participation in research, the New York utilities seriously question the advisability of proceeding with acid precipitation legislation at this time. We hold the view that the existing scientific studies are sending very mixed signals about the significance atmospheric acidity's role plays as a source of deleterious environmental impacts. We urge that additional facts be ascertained.

Mr. Chairman, there is considerable uncertainty whether the proposal to drastically decrease sulfur emissions from power plants will have any demonstrable beneficial environmental results. On the other hand, the huge cost and economic impact of implementing such emission reductions is obvious. Therefore, the member systems of the New York Power Pool urge that enactment of the type of legislation being considered by your committee should await a better scientific understanding. We also urge Congress to support additional scientific research to: (1) Ascertain the nature and extent of environmental damage and (2) better define the most reasonable, effective, and economical ways of decreasing the environmental impacts, if and where they are found to be significant.

We are deeply concerned that S. 768's approach of mandating decreased emissions will not result in demonstrable environmental benefits, but will significantly increase the cost of a basic energy source -- electricity so vital to our economy.

We thank you for the opportunity to appear before you and to present our views. I would be happy to answer any questions that you may have.

Statement of

NEAL S. TOSTENSON
President

OHIO MINING AND RECLAMATION ASSOCIATION

Columbus, Ohio

ACID RAIN LEGISLATION AND OHIO

I am Neal S. Tostenson, president of Ohio Mining and Reclamation Association, 50 S. Young St., Columbus, Ohio.

The Ohio Mining and Reclamation Association is an organization of approximately 100 operating coal companies in Ohio, engaged in both surface and underground mining for coal.

This coal mining takes place in about 26 counties in the south-eastern part of Ohio.

I am here today to relate to you what is happening to the Ohio coal industry as a result of the sulfur dioxide standards and the possible effect that acid rain legislation would have on the Ohio coal industry and on the communities where our workers live.

So there is no question as to what our position is on the proposed legislation pending before this committee, we have analyzed the effect of the previous EPA regulations governing emission standards for sulfur dioxide at power plants in Ohio and realize what it would take on the part of the utilities to bring about the reduction requested in the pending legislation. If this legislation is passed, it will create a wasteland in southeastern Ohio, more severe than any war in our history. It will devastate the Ohio coal industry.

Coal production will drop 60%, with resulting unemployment on top of thousands of already unemployed coal miners in eastern Ohio today. The only jobs that would be available would be government jobs, handing out welfare assistance and checks.

There is very little industry still operating in southeastern Ohio. The coal industry is the economic base that pays the taxes for our schools, and the upkeep of our counties. If this major source of revenue is wiped out, that part of Ohio will look like a gold mine ghost town.

Let's look at what has happened in Ohio, the largest coal-consuming state in the union, since 1970. In 1970, Ohio produced 55 million tons of coal. Since that year, production has gone downhill to a record low of 31.7 million tons in 1983. During that same period of time, coal production in Wyoming has gone from 7.2 million tons to a record high of 116 million tons in 1983. This drop in production in Ohio is not the result of a lack of capacity. There are several deep mines idle in Ohio, awaiting a return of the coal freight train. The landscape is dotted with large mining shovels, such as the Mountaineer, which only serves today as a reminder of a once proud industry and employer in eastern Ohio.

Many underground mines have totally closed their operations and sealed the entrances, resulting in over 9,000 unemployed coal miners in Ohio. Last year alone, we had a drop in production of 5 million tons, with a resulting loss to the Ohio economy of $140 million, of which $75 million is wages. We see further drops in production as Peabody Coal Company's Sunnyhill Mine does not expect to be able to continue operation with the loss of a utility customer in Michigan.

The primary, basic reason for the drop in coal production in Ohio is the implementation of sulfur dioxide standards, not only at Ohio power plants, but neighboring states as well. One time Steubenville, Ohio had the reputation of having the dirtiest air in the country. Today Steubenville has clean air; nobody is working. Factories have closed, steel mills are down, and unemployment lines have lengthened.

Because of air standards, Ohio has suffered economically in the last decade. However, SO_2 emissions have decreased from 5.203 lbs. of sulfur per million btu to 4.117, resulting in no SO_2 violations in Ohio during the 1980s.

This brings us to a consideration of what one million tons of coal means to Ohio. It means approximately $28 million in the Ohio economy. It means 725 jobs, either direct or indirect, and the resulting payroll. It means increased tax revenue for the state, revenue for local schools, and most of all, it means economical energy for manufacturing facilities.

This brings us to the proposed acid rain legislation which would decimate our coal industry. From the volumes and stacks of materials which I have reviewed, at this time there does not seem to be a concensus by the scientific community on many of the questions involved, indicating that we should proceed with so-called corrective legislation.

The number one question is where is the transport of acid precipitation coming from that is being deposited in the Adirondacks or New England, or south-eastern Canada? Where is this acidic precipitation coming from that the Minnesota people are crying about? There are no definite or positive answers to these fundamental questions.

The second question is what is the process of transformation and what are the catylists involved? What is the atmospheric chemistry we are talking about, with any scientific certainty?

3. Will the proposed legislation, which we are considering here today, solve any problems? Will it bring about the desired results in the Adirondacks and White Face Mountain, the New England

states, or Canada?

In the fall of 1982, I attended a Senate hearing, and at that time nobody had any reasonable scientific basis to conclude that a 50% reduction in emissions in the midwestern high sulfur coal states would result in a substantial cleanup of the air in the Adirondacks or New England.

4. What is necessary to reasonably assure the people of this country that for the money being spent the mission will be accomplished? The scientific community does not have the answer at this time. How then, can we legislate a cure if we do not know the processes?

Probably the most important question of all is why pick the SO_2 emissions in 1980? The reason I ask this is that Ohio has done a tremendous job in reducing their emissions while many states in the northeast have increased their emissions over the same period.

It has been said that acid rain decreases yield of corn and soy bean crops, but the scientists at the University of Illinois find otherwise. (see attached exhibit.)

Let us find Diogenes and his dog, and hopefully the truth will follow.

Probably the most important factor that must be analyzed is the lion waiting in the shadows ready to grab the prey -- the Canadian electric utilities desirous of capturing the electric market in the United States. Currently in Ontario there are four nuclear power plants under construction, with four units each. In the meantime, nuclear power plant construction in the U.S. has crawled to a stop. Currently there is an excess of electric capacity in Canada. How will they pay for the nuclear stations coming on line in the 80s, unless they find new customers? That's why they are after the U.S. market, and that's why the Canadian government has over a $1 million propaganda program, selling acid rain reduction to the U.S. Congress.

They indicate they are willing to spend $500 million on air pollution controls by the end of this decade. One power plant in Ohio is spending that sum just on particulate control.

What has Ohio done over the past decade?

1. Ohio has reduced SO_2 emissions over 20%.
2. Ohio has spent more on air and water pollution controls in the last decade than any other state in the union.
3. Ohio Edison Co., an electric utility, is spending $500 million on particulate clean up at their Sammis plant, more than the Canadians plan to spend on total air pollution control.
4. Ohio coal operators have built or updated, over 25 coal preparation plants to wash coal in the last five years.
5. Ohio has not had a sulfur dioxide emission violation during the 1980s.
6. Ohio is working toward new technologies to burn coal in an environmental manner. Our governor has had introduced in the Ohio General Assembly legislation to create a Coal Development Agency to speed up the development of new technology in Ohio.

In Ohio we are proud of what we have done and where we are going. We are proud of what we can do for the New England States.

If the New England States, New York and New Jersey were to convert their power plants from oil and gas to Ohio coal, we could play a major role in decreasing the export of dollars overseas for foreign oil.

It would help maintain the rail system in the east that has been struggling for many years and which will be needed as a vital link in our defense structure.

It would provide additional jobs in the heartlands of Ohio, mining coal, and in turn helping the national economy.

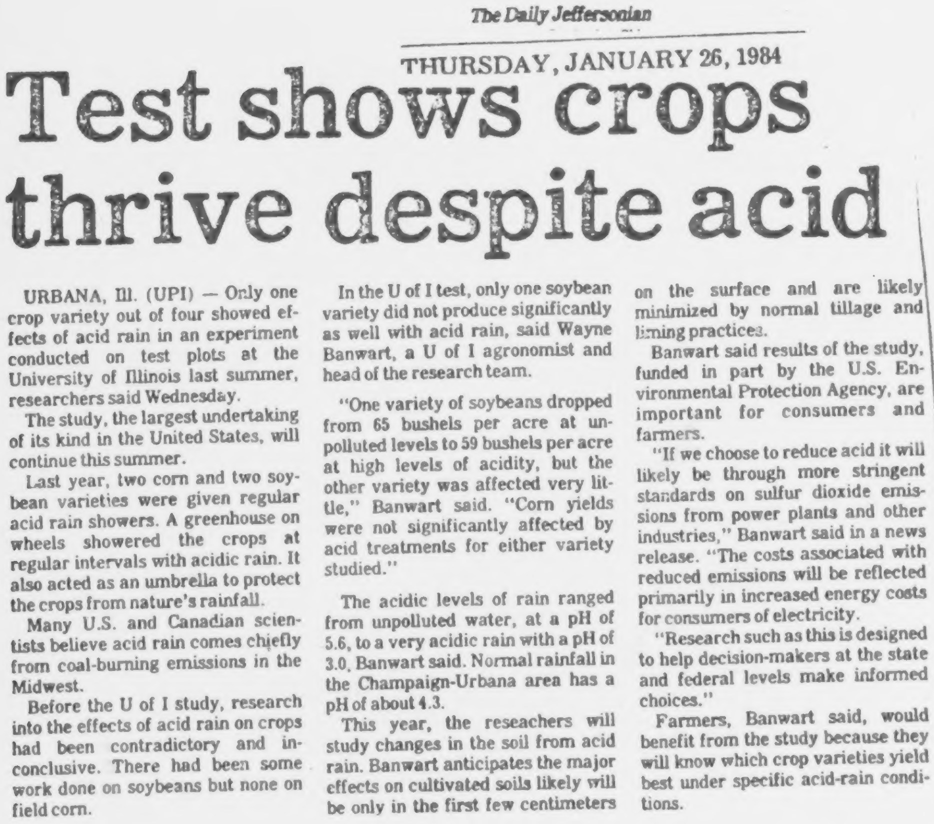
Finally, the homeowners in New England would have lower electric utility rates.

This is what Ohio can do for you, and this should be the focus of an action agenda today -- an urge for further development for research knowledge about acid depsoition so that when the answers are on the table we can make the wisest use of our natural resources, and protect the fish in the Adirondacks.

Thank you for this opportunity to testify. I will be available to answer any questions you may have.

ANNUAL COAL PRODUCTION
(MILLION TONS)

	OHIO	U.S.	WYOMING
1983	31.7	810.	116.
1982	37.	820.	107.8
1981	37.3	818.	102.9
1980	40.	823.5	95.
1979	43.5	776.2	71.5
1978	40.	665.1	53.3
1977	47.	691.3	46.
1976	46.8	678.4	30.8
1975	46.	648.4	23.8
1974	45.	603.4	20.7
1973	45.6	591.7	14.3
1972	50.5	595.4	10.9
1971	49.	552.2	8.
1970	55.	602.9	7.2



The Daily Jeffersonian

THURSDAY, JANUARY 26, 1984

Test shows crops thrive despite acid

URBANA, Ill. (UPI) — Only one crop variety out of four showed effects of acid rain in an experiment conducted on test plots at the University of Illinois last summer, researchers said Wednesday.

The study, the largest undertaking of its kind in the United States, will continue this summer.

Last year, two corn and two soybean varieties were given regular acid rain showers. A greenhouse on wheels showered the crops at regular intervals with acidic rain. It also acted as an umbrella to protect the crops from nature's rainfall.

Many U.S. and Canadian scientists believe acid rain comes chiefly from coal-burning emissions in the Midwest.

Before the U of I study, research into the effects of acid rain on crops had been contradictory and inconclusive. There had been some work done on soybeans but none on field corn.

In the U of I test, only one soybean variety did not produce significantly as well with acid rain, said Wayne Banwart, a U of I agronomist and head of the research team.

"One variety of soybeans dropped from 65 bushels per acre at unpolluted levels to 59 bushels per acre at high levels of acidity, but the other variety was affected very little," Banwart said. "Corn yields were not significantly affected by acid treatments for either variety studied."

The acidic levels of rain ranged from unpolluted water, at a pH of 5.6, to a very acidic rain with a pH of 3.0, Banwart said. Normal rainfall in the Champaign-Urbana area has a pH of about 4.3.

This year, the reseachers will study changes in the soil from acid rain. Banwart anticipates the major effects on cultivated soils likely will be only in the first few centimeters on the surface and are likely minimized by normal tillage and liming practices.

Banwart said results of the study, funded in part by the U.S. Environmental Protection Agency, are important for consumers and farmers.

"If we choose to reduce acid it will likely be through more stringent standards on sulfur dioxide emissions from power plants and other industries," Banwart said in a news release. "The costs associated with reduced emissions will be reflected primarily in increased energy costs for consumers of electricity.

"Research such as this is designed to help decision-makers at the state and federal levels make informed choices."

Farmers, Banwart said, would benefit from the study because they will know which crop varieties yield best under specific acid-rain conditions.

Testimony of

James V. Scahill, Executive Vice-President
Wilson Fisher, Technical Committee Chairman

Pennsylvania Coal Mining Association

before the

U.S. Senate
Committee on Environment and Public Works

February 10, 1984

Washington, D.C.

Testimony of James Scahill, Executive Vice-President, and Wilson Fisher, Technical Committee Chairman, Pennsylvania Coal Mining Association (PCMA) before U.S. Senate Committee on Environment and Public Works, Washington, D.C., Friday, February 10, 1984.

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE,

I AM JAMES SCAHILL, EXECUTIVE VICE-PRESIDENT OF THE PENNSYLVANIA COAL MINING ASSOCIATION, A TRADE ASSOCIATION REPRESENTING THE SURFACE MINING INDUSTRY IN PENNSYLVANIA. APPEARING WITH ME IS WILSON FISHER, CHAIRMAN OF PCMA'S TECHNICAL COMMITTEE. PCMA IS PLEASED TO BE GIVEN THE OPPORTUNITY TO PROVIDE OUR INSIGHTS TO THIS COMMITTEE IN ITS REVIEW OF PROPOSALS CONCERNING ACID RAIN.

WE HAVE TO REVIEW HISTORY IN AN ATTEMPT TO PUT PERSPECTIVE TO THE ACID RAIN DEBATE. PENNSYLVANIA IS BLESSED WITH 30 BILLION TONS OF RECOVERABLE COAL, AND HAS MINED AND BURNED 23 BILLION TONS IN ITS 260-YEAR MINING HISTORY. BUT THERE IS A SNAG TODAY, FOR THE MAJORITY OF PENNSYLVANIA COAL CONTAINS MEDIUM TO HIGH SULFUR. TO SHOW JUST HOW SILLY IT IS TO BLAME COAL BURNING FOR THE RECENT ACID RAIN PROBLEM CAN BE ILLUSTRATED BY OUR PRODUCTION FIGURES. CURRENTLY, PENNSYLVANIA BURNS 55-60 MILLION TONS PER YEAR. IN 1917-1918, WE MINED AND BURNED 548 MILLION TONS, OR TWO/THIRDS OF PRESENT U.S. PRODUCTION (829 MILLION TONS-1982). SURELY THE ACID RAIN ISSUE SHOULD HAVE SURFACED LONG BEFORE IT DID IN THE EARLY 1960'S. THE CLEAN AIR ACT OF 1970 DEVASTATED THE MINING INDUSTRY IN PENNSYLVANIA, WITH ITS EFFECTS STILL BEING FELT. DUE TO THE ACT, PENNSYLVANIA NOW IMPORTS 15 MILLION TONS ANNUALLY FROM OTHER STATES TO COMPLY WITH PROVISIONS OF THE ACT. THAT TONNAGE DISPLACEMENT HAS RESULTED IN THE LOSS OF OVER 4,000 PERMANENT MINING JOBS AND 10,000-20,000 SUPPORTING JOBS. IT HAS ALSO RESULTED IN SOCIO-ECONOMIC UPHEAVALS IN OUR MINING TOWNS. AS YOU CONSIDER THE BILLS NOW BEFORE YOU, PCMA URGES THAT YOU CONSIDER THAT EMPLOYMENT DEVASTATION, SOMETHING THAT WASN'T CONSIDERED IN PASSAGE OF THE CLEAN AIR ACT. SO_2 EMISSION REDUCTION BILLS CURRENTLY BEING STUDIED IN CONGRESS WILL HAVE THE FOLLOWING RESULT:

	DIRECT JOB LOSS	TOTAL JOB LOSS
PENNSYLVANIA	2,300 - 3,700	7,500 - 12,000
OHIO	5,900 - 6,450	19,000 - 21,000
WEST VIRGINIA	1,000 - 7,500	3,400 - 24,500

SOURCE: *Congressional Research Service; Pennsylvania State University*

TO A REGION THAT CAN ALREADY TRACE PART OF ITS ECONOMIC PROBLEMS TO PAYING A DISPROPORTIONATE SHARE OF THE COST, ANY FURTHER REDUCTION IN SO_2 EMISSIONS IS UNTHINKABLE.

VERY LITTLE HAS BEEN MENTIONED ABOUT THE INDIRECT BUT COSTLY ECONOMIC BURDEN THAT HAS ALSO BEEN PLACED ON THE ELECTRIC CONSUMER. THE OFTEN QUOTED HARRIS POLL ASKED THE LOADED QUESTION "DO YOU WANT CLEAN AIR" PAYING SCANT ATTENTION TO THE EXACT AMOUNT THE AMERICAN PUBLIC IS WILLING TO PAY FOR CURRENT OR FUTURE ENVIRONMENTAL CONTROL COSTS. SURPRISINGLY, ONLY 78% SURVEYED WANTED CLEAN AIR - PERHAPS THE OTHER 22% WERE OUT OF WORK! IN THE ONLY STUDY TO DATE ON THE MATTER OF COST CONSUMERS WOULD BE WILLING TO PAY TO SUPPORT ACID PRECIPITATION CONTROLS, MISSOURI VOTERS RESPONDED:

30% - WILLING TO PAY NO EXTRA COST
32% - WILLING TO PAY NO MORE THAN $1-$5 PER MONTH
ONLY 2% - WILLING TO PAY THE ESTIMATED $25 PER MONTH INCREASE

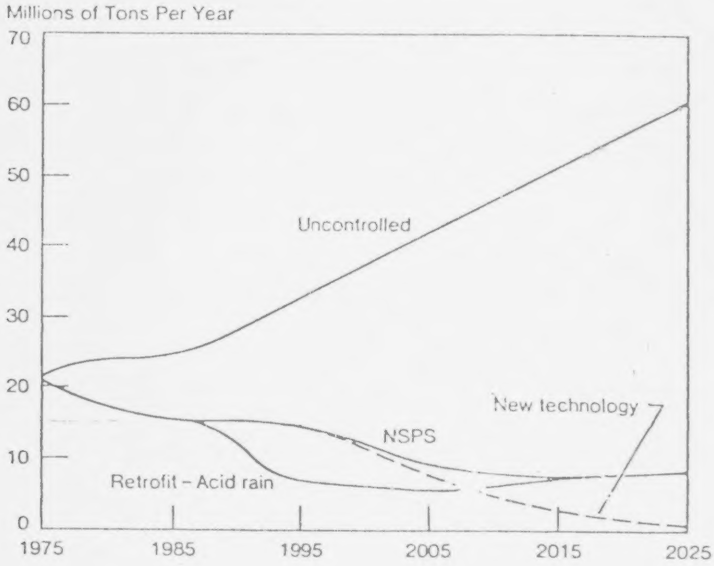
SOURCE: Union Electric Company, St. Louis, MO

FORGET FOR A MOMENT THE $20-200 BILLION ESTIMATED COST OF ANY FURTHER SO_2 EMISSION REDUCTIONS OR THE MIT STUDY THAT ESTIMATED ONLY AN INCREASE OF .15 PH IF ALL SO_2 AND NO_x EMISSIONS WERE TOTALLY ELIMINATED. THE AMERICAN PUBLIC HAS BEEN DUPED INTO BELIEVING THAT POLLUTION CONTROL COSTS ARE MINIMAL BY THE ENVIRONMENTALISTS. THE NATIONAL WILDLIFE FEDERATION IS PRESENTLY TELLING THE PUBLIC THAT FURTHER SO_2 EMISSION REDUCTIONS WILL ONLY COST THEM 67¢ PER ELECTRIC BILL, AN ARGUMENT THE ENVIRONMENTALISTS USED IN 1969 (LOW COST TO THE PUBLIC) IN URGING PASSAGE OF THE CLEAN AIR ACT. LET'S LOOK AT THE ACTUAL FIGURES. COMPARED WITH UTILITIES' PRESENT ENVIRONMENTAL CONTROL COSTS, AND USING THE 1969 ENVIRONMENTALIST'S FIGURE OF A 50¢ PER BILL, IT WOULD MEAN THAT EVERYONE'S ELECTRIC BILL SHOULD BE $4 TO $6 MONTHLY; FOR THE PRESENT CONTROL COST TO UTILITIES IS 15% OF A CONSUMER'S MONTHLY BILL. CONSUMERS ARE PRESENTLY PAYING $4 TO $20+ PER ELECTRIC BILL FOR ENVIRONMENTAL CONTROL COST. WHEN COMPARED WITH THE ABOVE MISSOURI SURVEY, 62% OF THOSE PEOPLE HAVE ALREADY REACHED THE LIMIT OF WHAT THEY ARE WILLING TO PAY FOR CONTROLS. MORE FRIGHTENING, THE CLEAN AIR ACT IS DESIGNED TO REPLACE OLDER PLANTS WITH NEW SOURCE PLANTS. ACCORDING TO SOME UTILITIES, ENVIRONMENTAL CONTROL COSTS CONSTITUTE 33% OF A CONSUMER'S MONTHLY ELECTRIC BILL FOR NEW SOURCE PLANTS. RIGHT NOW! THE COST FOR FURTHER REDUCTION OF SO_2 EMISSIONS HAS BEEN ESTIMATED TO COST THE CONSUMER AN ADDITIONAL 50% OF THEIR TOTAL MONTHLY BILL. THE AMERICAN PUBLIC SHOULD BE SHOWN WHAT THEY PAY FOR CONTROLS. SINCE ENVIRONMENTAL CONTROL COSTS ARE NOT ASSOCIATED WITH THE ACTUAL GENERATION OF THE ELECTRICITY, UTILITIES SHOULD BE URGED TO BREAK

OUT THOSE TOTAL COSTS ON MONTHLY ELECTRIC BILLS.

FURTHER REDUCTIONS IN SO_2 EMISSIONS ARE UNNECESSARY BECAUSE THE CLEAN AIR ACT, COSTLY TO BOTH THE MINING COMMUNITY AND THE ELECTRIC CONSUMER, WILL ACHIEVE THE SAME RESULTS IF ALLOWED TO WORK. IT IS HARD TO UNDERSTAND HOW THE ENVIRONMENTALISTS CAN CLAIM ACID RAIN IS GETTING WORSE DUE TO COAL-FIRED POWER PLANTS WHILE EPA STUDIES HAVE SHOWN A 15-18% REDUCTION IN SO_2 EMISSIONS DURING THE SAME TIME PERIOD.

UTILITY SO_x EMISSION TRENDS



Based on EPA emission data and projections adjusted to reflect current utility growth projections.

THE CHART ILLUSTRATES THAT PROVISIONS OF THE CLEAN AIR ACT (NSPS LINE) AND PROPOSED SO_2 REDUCTION BILLS (RETROFIT-ACID RAIN LINE) WILL MERGE IN THE YEAR 2015, WITH FURTHER BENEFITS IN REDUCTION DUE TO NEW TECHNOLOGY ESTIMATED.

A MEDIA/ENVIRONMENTALIST IMAGE HAS BEEN CREATED THAT COAL-FIRED POWER PLANTS IN THE MID-WEST ARE THE LARGEST CAUSE OF ACID RAIN IN THE NORTHEAST. YET THERE IS NO CONCLUSIVE SCIENTIFIC BACKING FOR

FOR THESE CLAIMS. THE NORTHEAST IS PORTRAYED AS PRISTINE. AGAIN, NOTHING COULD BE FURTHER FROM THE TRUTH. NO_x FROM OIL-FIRED POWER PLANTS AND VEHICULAR TRANSPORTATION ACCOUNT FOR 40-50% OF THE TOTAL EMISSIONS THAT MAY CAUSE ACID RAIN. AND THE NORTHEAST IS NOT PURE WHITE WHEN IT COMES TO EMISSIONS, AND MORE IMPORTANTLY, EMISSIONS DENSITY. EMISSION DENSITY IS ANOTHER ASPECT OF THE ACID RAIN DEBATE OVERLOOKED BY THE MEDIA. THE FOLLOWING IS PRESENTED:

Total Emissions and Emissions Densities

NORTHEASTERN	Total Annual Emissions, SO_2 & NO_x	Emissions Density (Tons per Square Mile per Year)
Connecticut	206	41
Maine	154	5
Massachusetts	598	72
New Hampshire	149	16
New Jersey	685	87
New York	1,624	33
Rhode Island	52	43
Vermont	33	3
Total NE	3,501	300
Pennsylvania	3,060	68
MIDWESTERN		
Illinois	2,476	44
Indiana	2,781	77
Kentucky	1,406	35
Ohio	3,792	92
Michigan	1,597	27
Missouri	1,869	27
West Virginia	1,540	64
Total MW	15,461	366

SOURCE: U.S./Canada Work Group 3B(1982)

FROM THE GRAPH, THE SENATORS FROM VERMONT AND MAINE DO HAVE CAUSE TO BE ALARMED. HOWEVER, WE BELIEVE THEY SHOULD LOOK TO THEIR NEIGHBORS FIRST. PENNSYLVANIA IS ENTERED BY ITSELF BECAUSE OF ITS UNIQUE POSITION IN THIS DEBATE. IF IT WAS CONSIDERED PART OF NORTHEAST, THE NORTHEAST, A MUCH SMALLER GEOGRAPHIC AREA, WITH ONLY ONE/THIRD OF THE EMISSIONS, WOULD HAVE GREATER EMISSION DENSITY THAN THE ENTIRE MIDWEST.

CANADA HAS ENTERED THE ACID RAIN DEBATE, CALLING FOR THE UNITED STATES TO FURTHER REDUCE ITS EMISSIONS. BESIDES THE OBVIOUS ECONOMIC GAIN IN SUPPLYING THE U.S. WITH ITS EXCESS ELECTRIC CAPACITY, THE CANADIANS SHOULD BE SUSPECT FOR ANOTHER REASON. THIS TIME THE

AMERICAN ENVIRONMENTAL COMMUNITY IS BEING DUPED IN JOINING FORCES WITH THE CANADIANS. ONCE AGAIN, LET'S LOOK AT THE CLEAN AIR ACT. THE CANADIANS WERE EVERY BIT AS FORCEFUL IN THE LATE 60'S IN SUPPORT OF CONTROLS. THEY MADE PROMISES AT THAT TIME THAT CANADA WOULD HAVE A STRONG ENVIRONMENTAL CONTROL PROGRAM IN PLACE BY 1980. WHERE ARE THOSE CONTROLS???? THERE ARE 86 SCRUBBERS IN NORTH AMERICA, NONE IN CANADA. IN FACT, THE CANADIANS HAVE DONE LITTLE BY WAY OF ENVIRONMENTAL CONTROLS - SUDBURY, ONTARIO'S NICKEL SMELTER BEING THE PRIME EXAMPLE. IN THE CURRENT DEBATE ON ACID RAIN, THE CANADIANS ARE MORE THAN WILLING TO MAKE MORE PROMISES. I BELIEVE THAT THEY HAVE PROMISED CONTROLS BY 1990. ACCORDING TO ONE REPORT, THE CANADIANS WOULD HAVE TO HAVE A 50% ACROSS THE BOARD REDUCTION RIGHT NOW TO CATCH UP WITH THE EFFORTS OF THE UNITED STATES. IS 1990 TO ARRIVE, WITH THE UNITED STATES FINDING THAT THE CANADIANS HAVE BEEN SO BUSY SELLING US THEIR ELECTRICITY THAT THEY DIDN'T HAVE TIME TO INSTALL POLLUTION CONTROL EQUIPMENT?

IN CONCLUSION, DUE TO THE ABOVE REASONS, AS WELL AS THE UNCERTAINTY OF JUST WHAT THE CAUSE AND EFFECTS OF ACID RAIN REALLY ARE, PCMA HAS ALREADY GONE ON RECORD SUPPORTING SENATOR BYRD'S AND REPRESENTATIVE RAHALL'S POSITION OF ACCELERATED RESEARCH TO FIND THOSE ANSWERS BEFORE WE SPEND BILLIONS OF DOLLARS ON SO_2 EMISSION REDUCTION - AN EXPERIMENT.

THANK YOU, GENTLEMEN.

STATEMENT OF RALPH W. ABELE
EXECUTIVE DIRECTOR
PENNSYLVANIA FISH COMMISSION
BEFORE THE
SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE
10 February 1984

Thank you for the opportunity to express my concerns about the trend that has manifested itself on the impact of acid deposition to the environment of Pennsylvania, particularly on our fisheries. As Executive Director of the Pennsylvania Fish Commission, an independent agency not under the governor's jurisdiction, my position does not reflect that of the current state administration.

Pennsylvania is in the 'eye' of the acid deposition storms. Downwind of the Ohio Valley, the nation's greatest industrial complex, which indeed includes our own steel capital of Pittsburgh, we receive, not surprisingly, the most acidic precipitation in the world over so large an area. In fact, our state has been identified by some as 'Keystone' to the entire clean air issue. Consider this: after Ohio, Pennsylvania is the greatest perpetrator of SO^2 in the nation, and, with a current broadly recorded average precipitation pH of 4.0 to 4.1, we are fast becoming its primary victim as well.

You have, I am certain, heard witnesses from both sides testify to the impacts on agriculture, forest die-back (which forced Germany to enact legislation leading to a 50% SO^2

reduction by 1990) buildings, gravestones, concrete and steel bridges, and human health. Therefore, my comments focus upon a succinct summation of what we have observed occurring to the fisheries of our state. The brochure which I have made available dramatically illustrates the current breadth of these damages.

A review of historical (pre 1970) and current chemical characteristics - pH and alkalinity - of our small, pristine mountain streams reveals a most alarming trend. Of 41 such streams, randomly selected, which naturally offer the poorest buffering capacity, pH of only 3 increased over a span of 15 years, while 19 decreased. More significantly, the alkalinity, a less volatile, precursory parameter, decreased on 37 streams and showed an inconclusive trend on the other 4. Most alarming, the average alkalinity of these streams decreased from 20PPM to 9PPM during this brief time frame.

By 1981, 5,100 miles of stocked and unstocked trout streams had an alkalinity ≤ 10PPM. Water with a buffering capacity of 10PPM (200 micro equivilents) or less was classified as vulnerable to fisheries loss by the Stockholm Conference in 1982. Few of these waters were vulnerable in the early 1960's. We are desolated by the fact that these vulnerable streams represent our state's very highest quality trout fishery. This quality, however, is being gradually eroded, and even now, year classes of trout recruitment are lost when heavy acid snowmelt coincides with trout fry emergence from eggs in late winter.

During the past twenty years, increasing acidification of our waters has forced us to make management changes, up to and including termination of stocking, on seventy trout streams, and, based upon the long standing criterion of a minimum pH of 6, we should no longer be stocking dozens more.

Our current and historical data on lakes are less complete, and therefore less reliable, than our stream data. However, based upon surveys of about 100 lakes, we find that 26% of them, primarily the smaller, more pristine waters, are also vulnerable.

As the unit fishing pressure on our resources,most particularly our trout waters, is the heaviest in the nation, according to the Sport Fishing Institute, we can ill afford to lose any of these fisheries. However, if the trend of alkalinity loss which we've experienced for the past 16 years continues, there will be 5,000 miles of former basically high quality trout streams which will be either fishless or approaching that condition by the end of this century.

This is why I must conclude that acid precipitation is the most serious threat ever faced by Pennsylvania's fisheries. I say this in the full knowledge that acid mine drainage once destroyed over 3,000 miles of major stream fisheries in Pennsylvania.

By the widely used 'travel cost plus consumer surplus' method of evaluating recreational values, loss of these 5,000 miles of trout stream fisheries equates to a loss of economic value in excess of $100 million annually, or, at a 10% discount rate, a capitalized value of over $1 billion. This is Pennsylvania's indirect answer to David Stockman's question, "What are 170 lakes (in the Adirondacks) worth"?

It is impossible for me to accept the arguments of industry. Industry says the rain has always been acidic; volcanoes are responsible; the soils are responsible; the maturing forests are responsible; the rain hasn't become any more acid this decade, etc.

Does this sound familiar? Mr. Horrigan, of Reynolds Tobacco, is again telling the nation's young smokers that they really have nothing to worry about because "science has failed to establish a causal link" between cancer, emphysema, heart disease and smoking. Is it also a coincidence that trout have lived for thousands of years in our headwater streams, many of which in a few short years are now being rendered incapable of supporting them?

The loss of alkalinity in our soil, bedrock and water is a cumulative process. Alkalinity cannot be restored. Holding the line with rainfall pH means only that the deterioration will continue at the current rate. The hour is late; there is no longer a guarantee that even expeditious action will save all of our streams and forests. But many experts are convinced that strong emission controls would have immediate beneficial impacts on human health, agriculture, concrete, stones, paint, metals, etc., now adversely effected.

I'd rather not have to explain to my grandchildren why we did nothing to prevent this environmental holocaust. Attempts by another generation to justify the incredible degradation left in the wake of deep and surface coal mining have not created much sympathy.

I have no problem with additional research, conducted - along with, not as a substitute for - the action we so desperately need. Do we need a warm body and a smoking gun before we take this action? I'm afraid that a few more years will give us the well documented disaster industry and this administration insist upon.

Halving of SO^2 emissions within a decade is financially feasible. Halfway measures, such as a 5 million ton reduction, or more research, simply avoid the urgency as I see it. As great as is my concern for our recreational fisheries, a greater concern is the role of fish as the miner's canary. The canary is in distress. Giving it oxygen is not the answer, any more than is industries' absurd solution, 'lime the lakes'. Similarly, a token, 5 million ton reduction would result in only coal washing and fuel switching. These reponses alone would not position the perpetrators for the ultimate goal of a 50% reduction in emissions and deposition.

Mr. Chairman, Senate Bill 769 represents the type of response that is required to finally turn this dreadful scourge around. We have been told by the National Academy of Science that a 50% reduction of SO^2 will be required in the Eastern

United States. I am also pleased to see that certain restraints are placed upon mobile sources. Lou Harris has told us that Americans are solidly behind taking this action, even if it does mean money out of their pockets.

Based upon the trend which is evident in Pennsylvania as a result of the current deposition rate, our losses will become intolerable in another 10 years. The time schedule for implementation of SB 769 is too lenient to protect many, if not most of our currently vulnerable streams. I noted that Germany has undertaken a 50% reduction inside of 10 years just to save her forests. Japan also installed over 1,000 scrubbers primarily to protect the health of her citizens.

The United States, given the experience of these two countries, and starting later, cannot afford to do less or to do it more slowly.

STATEMENT FOR THE RECORD

OF

EVERN R. WALL
PRESIDENT
WESTERN ENERGY SUPPLY AND TRANSMISSION
(WEST) ASSOCIATES

On behalf of WESTERN ENERGY SUPPLY AND TRANSMISSION (WEST) ASSOCIATES, I thank the Committee for the opportunity to testify on an issue of significant concern to the Western States -- acid rain.

I am Evern Wall, President of WEST Associates and President and Chief Executive Officer of El Paso Electric Companu, an investor-owned utility in Texas.

WEST is a research and information group of 21 publicly-owned and investor-owned electric utilities covering about 18.5 million consumers in eight Western and Southwestern states. In the past, WEST has articulated broad principles on a variety of Clean Air issues -- with individual members giving the details of their particular views. WEST has adopted this same approach regarding acid rain.

My statement today is divided into three parts; first, it provides an overall Western perspective on the acid rain issue; second, it points out key regional differences which must be considered in any acid rain discussion; and third, it describes basic principles which ought to help guide any acid rain legislation.

I. Western Perspective

When it comes to acid rain, it seems the only consensus is that a problem may exist. There is no consensus about whether, or even how, to control the phenomenon. One reason is that many scientific questions remain unanswered.

While the current state of knowledge of acid rain's causes and effects seem to be inadequate to justify or select a control strategy now, the science of the issue is only one dimension of the debate. Another key dimension is the need for equity and fairness in _any_ acid rain program, irrespective of its technical merit.

Just about every affected interest group in the East seems to have spoken out on the acid rain issue. But only recently have Westerners begun to get involved.

In the Summer of 1983, and for the first time, the West was pulled directly into a legislative proposal regarding acid rain. H.R. 3400, introduced by Congressmen Sikorski of Minnesota and Waxman of California, proposes a tax of one-tenth of a cent on each (non-nuclear) kilowatt hour of electricity generated by every utility in the Continental U.S. The tax in H.R. 3400 is designed to pay a portion of the costs of installing pollution-reducing equipment on the 50 dirtiest power plants in the country -- all of which are located on or East of the Mississippi River. Following the Sikorski/Waxman Bill, other "cost-sharing" proposals have been offered in both the House and Senate -- many of which require Western consumers to pay to clean up another part of the country.

While acid rain may be a concern to many citizens in various parts of the United States, the issue affects different regions differently. In most parts of the West, for example, acid rain problems similar to those of the East do not exist. Yet, many acid rain "solutions" being discussed today may cost billions of dollars for consumers everywhere, with a disproportionate burden proposed to be placed on Western consumers.

Acid rain "cost-sharing" proposals -- ones which fail to account for critical regional differences and discriminate against consumers of one region for the benefit of another -- are bad public policy. The costs of a program should not be spread across the country in the form of an across-the-board electricity fee or tax, especially one which provides regional benefits selectively.

Among other things, such a program ignores the fact that Western utility customers already have spent billions to preserve the environmental quality of the region.

WEST recognizes that this Committee is considering provisions in S.768. That bill does not include a cost-sharing mechanism --and, as such, is a more equitable and realistic approach for the Western United States.

II. Key Regional Differences

Going beyond the substantial investment the West already has made in controlling emissions in the region, there are several key regional differences which must be kept in mind if an affordable and equitable national acid rain control effort is ever to be developed.

In sum, the 17-state West has, compared to the 31-state East:

- One-fifth the coal-fired electric generation -- which is purported to be one source of acid rain-related emissions;
- Much "cleaner" coal -- that is, coal with one-third the sulfur content;
- Four times the installed pollution control technology (scrubbers) -- relative to total generation.

A. Power Generation:

In the acid rain debate, the legislative emission-reduction programs proposed thus far specifically seek to cut levels in the sulfur dioxide (SO_2) and nitrogen dioxide (NOx) emissions. There are many natural and man-made sources of these emissions -- from forest fires to automobile exhausts to smelter emissions to urban smog and to fossil-fueled electric power plants. However, most control strategies are focused almost exclusively on power plants.

But the West only has a fraction of the coal-fueled power generation of the East; in fact, more than 81 per cent of the nation's generation is in the 31 Eastern states, versus less than 19 per cent in the 17 Western states.

B. Power Plant Emissions:

The West is "cleaner" than the East in terms of emissions because of the lower sulfur content in Western coal, and the higher level of existing SO_2 emissions controls. These controls already have cost Western utility rate payers billions of dollars.

Specifically, the average sulfur content of coal used by utilities in 31 Eastern states is about three times higher than coal used in the 17-state West -- an average of two per cent sulfur coal in the East versus .64 per cent in the West.

Additionally, the West has more than four times the East's percentage of coal-fueled power plants that already have installed equipment ("scrubbers") to cut pollution -- 31 per cent in the West, versus only seven per cent in the East.

These facts show that the emissions picture in the West clearly is different. Take emissions densities, for example: Peak densities in the East in 1980 range from six to twenty times those in the West. (See attached 1980 and 1995 SOx emissions densities maps.) *

A key fact is that only seven per cent of all SO_2 emissions from the nation's coal-fired power plants is attributed to the West.

C. Costs:

Under various cost-sharing proposals -- for example, a one mill per kilowatt hour tax, such as proposed in H.R. 3400 (Waxman/Sikorski) -- annual per capita costs for Western consumers would be \$10.25 -- or 35.6 per cent higher than the per capita cost to Eastern consumers (\$7.56).

Breaking it down even further, for five Mid-Western states with 21 of the top 50 SO_2 emitting power plants, the annual per capita costs would be eight per cent less than the

---

*Retained in committee files.

national average. On the other hand, consumers in the eight states of the Southwest and Rocky Mountain would end up with an annual per capita tax cost of 46 per cent more than the national average.

"Cost-sharing" on the basis of 1 mill per kilowatt hour amounts to an unfair transfer of nearly $700 million annually from Western utility ratepayers to the East, a particularly unfair and discriminatory proposal considering that all of the top fifty SO_2 - emitting power plants in the United States are on, or East of, the Mississippi River.

The West's committment to doing its "fair share" in terms of cleaning its emissions is evident in the following fact:

- Customers of the 21 WEST Associates' companies have paid, are paying or will pay by the mid-1980s approximately $2.4 billion for emissions controls on their utility's power plants alone.

III. WEST Principles

These important regional distinctions suggest that any acid rain legislation should adhere to a number of common sense principles:

1. The current state of scientific understanding of the causes and effects of acid rain is not adequate either to justify or select a control strategy. Any proposed acid rain control legislation which calls for reduction in emissions without assurance that benefits will be commensurate with the control costs would not be good public policy.

Basic questions remain about the rate of any increase in rainfall acidity, the role of natural buffers against acidity, the effects over time on fish and flora, and the exact causes and sources of acid rain.

In the West, however, there are fundamental differences which should affect substantially the acid rain debate -- differences in emissions, fuels, federal clean air standrads and other critical factors. Serious acid rain problems similar to those in the East do not exist in the West.

2. Any initial control efforts to reduce acid rain-related emissions should be applied where demonstrated significant acid rain problems exist or where damage has occurred. Further efforts should be based on research findings regarding acid sensitivity in other parts of the nation.

3. Least cost methods of meeting emission reduction targets should be used.

4. The costs of these reductions should not be spread over the country through an across-the-board national electricity tax or fee on utilities -- especially a tax or fee that fails to account for key regional differences. Responsibility for emission reductions should be incurred in relationship to contribution to the problem.

5. Unique regional distinctions must be fully considered -- including emissions reductions and clean-up already achieved; emissions densities; mobile, industrial and natural sources of various emissions; sulfur content of fossil fuels (especially coal); and applicable state and federal emission standards.

6. Resolution of scientific uncertainties through an aggressive research program must underlie development of a rational acid rain strategy.

WEST believes that adherence to these principles will help avoid legislation that imposes an inequitable regional burden on the West.

# # #

INFORMATION

WEST

ASSOCIATES

WEST Member Utilities

Arizona Electric Power Coop., Inc.
Benson, Arizona

Arizona Power Authority
Phoenix, Arizona

Arizona Public Service Co.
Phoenix, Arizona

City of Anaheim
  Public Utilities Department
Anaheim, California

City of Burbank
  Public Service Department
Burbank, California

City of Colorado Springs
  Department of Public Utilities
Colorado Springs, Colorado

City of Glendale
  Public Service Department
Glendale, California

City of Los Angeles
  Department of Water and Power
Los Angeles, California

City of Pasadena
  Water and Power Department
Pasadena, California

Colorado-Ute Electric Assn., Inc.
Montrose, Colorado

El Paso Electric Company
El Paso, Texas

Nevada Power Company
Las Vegas, Nevada

Pacific Power & Light Company
Portland, Oregon

Platte River Power Authority
Fort Collins, Colorado

Public Service Company of
  Colorado
Denver, Colorado

Public Service Company of
  New Mexico
Albuquerque, New Mexico

Salt River Project
Phoenix, Arizona

San Diego Gas & Electric Company
San Diego, California

Sierra Pacific Power Company
Reno, Nevada

Southern California Edison Company
Rosemead, California

Tucson Electric Power Company
Tucson, Arizona

STATEMENT OF THE WESTERN REGIONAL COUNCIL ON ACID RAIN CONTROL PROPOSALS
PRESENTED BY
Harry L. Storey
Before the
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
February 10, 1984

I am Harry L. Storey, Director for Industry and Legislative Affairs, the Anaconda Minerals Company in Denver, Colorado. I appear before you as Chairman of the Western Regional Council's Clean Air ad hoc Committee.

The Western Regional Council is a coalition of 46 companies active in the eight Rocky Mountain States. Our membership includes businesses engaged in financial, energy, mining, transportation, manufacturing and other enterprises.

The WRC has been actively interested in clean air issues since it was organized in 1977. We have worked with the Congress, the Administration and with western Governors on those clean air issues we believe uniquely impact the West. In the last two years we have come to fully realize that acid rain must be included among those issues. The WRC testified before this Committee in November with our comments on S. 768 and we appreciate this opportunity to appear before you again and elaborate on our recommendations regarding possible acid rain legislation.

Before explaining our concerns regarding acid rain control proposals, I want to reiterate that while the WRC agrees the acid rain issue deserves careful attention, it would be unfortunate if it were to deprive other important clean air issues of thorough consideration. We would hope that acid rain legislation would move in concert with other amendments to the Clean Air Act. These issues are highly interactive and they should be considered together.

Although there remain many fundamental questions about the causes and effects of acid rain, there is strong sentiment for Congress to enact legislation. In the absence of adequate scientific data, some proposals to address acid rain have tended to seek what have become regionally and economically divisive political solutions. These proposals go beyond the primary environmental goal of reducing acid rain and its effects and could have negative economic consequences in the West as well as throughout the entire nation. It is therefore imperative for us to be active in the acid rain debate.

Of the acid rain control proposals now before the Congress, we prefer the approaches taken in S. 768. We urge the Committee to adhere to the straightforward acid rain research and reduction concepts of that bill. It calls for SO_2 reductions in the region which appears to be most affected, permits source flexibility in achieving reductions, does not spread the cost beyond the source, and provides for research both within the acid rain region and nationally.

We in the WRC are concerned about the national implications of potential environmental damage in any region of the U.S., but we approach this issue with some assurance that the environmental problem of acid rain is not a western one. To date, research in the western states has not identified any serious acid precipitation problems. Some high alpine lakes which lay in granite formations with no natural buffering capacity are potentially sensitive. If we had acid precipitation of any duration or severity, lake damage would be possible, but neither has been confirmed. The WRC will cooperate in research efforts in our states to better ascertain if we do have acidic precipitation and if so, where, to what degree, and from what sources.

A number of factors contribute to the difference between the eastern and western regional situation: First, the drier climate of the West results in less acid formation in the atmosphere. Second, much of the West has a typically alkaline soil which provides buffering capacity with respect to acidic reactions. Third, there are fewer major emission sources in the West, and they are widely distributed geographically. Fourth, most existing western coal-fired stationary sources use low sulfur fuels and are already subject to the nation's most stringent emission limitations. For example, the State of Utah requires new utility sources to use low sulfur fuels and a 90 percent reduction of sulfur emissions. The State of Wyoming has a new source emission standard of 0.2 lbs. SO_2 per million BTU. Of the 17.3 million tons of SO_2 emitted annually by coal fired power plants in the U.S., only 455,000 tons, 3 percent, are emitted in the eight WRC states. As stationary emission sources in the West continue to reduce their emissions, the potential for acid deposition in the region decreases.

In the entire 17 western states thirty-one percent of the coal fired electrical generation is from plants with control technology, compared to only 7 percent in the East. The 17 western states emit only 7 percent of the nation's utility SO_2, 1.2 million tons, while generating 19 percent of the U.S. coal fired electricity. If the entire nation were proportionately meeting these emission levels, the total SO_2 emissions from coal fired utilities would be about 6 million tons.

Western consumers are currently paying approximately 25 percent of their electric bill for the installation and operation of that pollution control equipment. Montana Power's Colstrip units 3 & 4 will emit only 0.07 lbs SO_2 per million BTU. Of the $1.4 billion plant cost, $500 million, 35 percent, is for pollution control. Capital costs at the new Intermountain Power Project in Utah include $308 million for pollution control.

It should be understandable that we in the West oppose the spreading of the cost of emission reductions to control acid rain. Not only do we believe that spreading of the costs is unfair to those who are already paying for emission reductions, but we also believe that a spreading of the cost removes incentives for sources to seek cost effective emission controls. However, this question, "who pays?", has become the driving issue in much of the political debate on acid rain controls.

S. 768 does not spread the cost. We agree. Some legislative proposals would have the entire nation subsidize the costs of SO_2 reductions. We should not consider in environmental legislation the idea that the last one to comply, the last one to clean up, should be compensated for their delay. We believe that would be a bad precedent and can see no equity in proposals to spread the cost of emission reductions beyond the individual source.

S. 768, howver, does provide in Section 182 (h) for EPA and Treasury Department feasibility studies of a 31 state electrical fee and an emission reduction financing fund. Our opposition to spreading the cost is firm and we recommend the deletion of this study provision. Feasibility investigations of "spread the cost" concepts will only enhance the potential for their eventual enactment.

Some legislative proposals have also included provisions mandating the use of control technology. Again, we agree with the source flexibility provided in S. 768 for emission reductions. Mandatory scrubbing has nothing to do with the environmental problem of acid rain, but instead, with preserving midwestern high sulfur coal mining jobs. Coupling forced scrubbing to preserve jobs with a national cost sharing program for purposes of political coalitions obscures the environmental goal of acid rain legislation. It makes the national cost unnecessarily high in a period of economic recovery and high Federal deficits.

The Western Regional Council advocates flexibility in legislation to permit the source to determine the best and most cost effective approach for reducing its emissions. A facility which has to reduce emissions should be allowed to decide how to achieve the reductions in the most cost-effective manner and in a way that makes sense for the plant's location, anticipated life, contractual arrangements, anticipated load demands, and other factors.

Proponents of protecting high sulfur coal mining jobs claim there would be severe regional economic dislocation without mandatory scrubbing. We believe that the miner displacement issue is an overemphasized consideration in the acid rain debate. Studies indicate that if all affected utility sources were to select non-scrubbing options for emission reductions there would be some shifts in high sulfur vs. low sulfur coal mining employment and location. But there will be overall increases in coal mine employment of approximately 120,000 jobs over the next 15 years. Some employment shift can be anticipated within the states. The only exception is in approximately 20,000 jobs losses in Illinois and Ohio.

The cost difference between the mandatory control technology and flexibility to use the most cost effective approach for achieving SO_2 emission reductions of 10 million tons could be $20 billion or more. $20 billion dollars only buys in place job security for approximately 20,000 Illinois and Ohio high sulfur coal miners.

We believe there are more effective options available for dealing with the welfare of affected miners for less than $20 billion. If the Congress is concerned about worker displacement resulting from measures to address acid rain, that problem should be dealt with on its own. Extremely generous retraining, economic development, relocation, unemployment benefits, or early retirement benefits would cost far less for the region, the economy, and the Federal budget than would requiring facilities to install mandatory control technology.

There are other costs associated with a mandatory scrubbing scenario, environmental costs. We estimate, for example, that about 3 1/2 tons of sludge must be disposed of for each ton of SO_2 removed by conventional scrubbing.

In addition, mandatory scrubbing forgoes the possibility of achieving early SO_2 reductions. Coal washing, fuel blending, or fuel switching can be implemented quickly compared to the design and installation time required for scrubbers. By producing earlier program reductions, they would achieve greater cumulative benefits over the life of a 10 year SO_2 reduction program.

Major initial reductions in sulfur dioxide emissions from coal fired power plants can be achieved though coal washing, fuel blending, and use of low sulfur fuels. If enacted, the flexibility afforded under the Senate Environment and Public Works Committee bill, S. 768, could mean a mix of solutions for power plants. Some would likely install scrubbers even if not mandated. A review of the 50 largest emitters indicates that 11 are mine mouth power plants and would probably install scrubbing capacity. Two are retrofitting with scrubbers. The remaining number will and must be given the option to use the most cost effective control systems.

In regard to S. 768, the WRC recommends that the Committee clarify the language in Section 187 regarding enforceable emission reduction programs. Section 187 lists available options for flexibility in achieving emission reductions, but fuel switching is not specifically mentioned on that list. It is our understanding that the intention of the Committee is to allow fuel switching as a reduction method and we urge that the Committee add "fuel switching" to the list on page 77 of the bill.

The WRC recommends that emission reductions be achieved in phases with the results of a first phase providing additional scientific data upon which the reduction program can be assessed and additional reduction phases determined. We are not recommending to you what level of reductions should be sought at this time, however, we do believe that future reductions should be in response to research results. We support the continued research efforts afforded by the bill.

In November the WRC testified on two issues we feel are related to legislation before the Committee to address acid rain, interstate pollution and the percentage reduction requirements under the New Source Performance Standards. We are opposed to the interstate pollution provisions in Sec. 121 of S. 768. They would create an open ended parallel jurisdiction for clean air in the courts and we recommend that Sec. 121 be deleted from the bill. We also hope the Committee will attempt again to remove the percentage reduction requirements under New Source Performance Standards. We would encourage the Committee to set set SO_2 standards rather than the current percent reduction provisions under NSPS which have as their major impact an economic deterent to western low sulfur coal rather than environmental improvement.

The WRC encourages you to retain the approach to acid rain legislation now embodied in S. 768. We have found virtual agreement in the West among our Governors and business organizations on these recommendations. We believe they make economic sense and are environmentally sound. We recommend that you move ahead with research so we know the scientific basis upon which to reassess and make long term policy decisions. Begin reductions in the meantime, based upon what we do know and increase mitigation measures as initial reductions are being achieved. Permit flexibility in achieving SO_2 reductions and promote use of the most cost-effective methods available. Avoid spreading the cost as it will drive the total cost of reductions up, exacerbate economic effects, penalize those who have already cleaned up, and probably delay the realization of a first phase of reductions by encouraging installation of control technology.

I want to thank you again for the opportunity to express the views of the Western Regional Council. Thank you.

The Connecticut Agricultural Experiment Station

123 HUNTINGTON STREET BOX 1106 NEW HAVEN CONNECTICUT 06504

Founded 1875 *Putting science to work for society*

February 8, 1984

Curtis Moore, Esq.
Associate Counsel
Environment and Public Works Committee
U.S. Senate
Washington, D.C. 20510

Dear Atty. Moore:

I understand that the Senate Committee on Health and Environment (Sen. R. Stafford, Chm.) has scheduled hearings to deal with acid rain provisions of S.768 on February 2, 7, and 9 in Washington, D.C. Further, I understand that the hearing record for written testimony is open until February 23.

Therefore, I wish to submit in its entirety the enclosed article by E.C. Krug and C.R. Frink entitled "Acid rain on acid soil: a new perspective" and published in SCIENCE 221: 520-525, 1983. I believe that this article contains important new information on the role of soil acidity in the observed acidification of our lakes.

Sincerely yours,

Charles R. Frink

Charles R. Frink
Vice Director

Reprint Series
5 August 1983, Volume 221, pp. 520–525

SCIENCE

Acid Rain on Acid Soil: A New Perspective

Edward C. Krug and Charles R. Frink

Copyright © 1983 by the American Association for the Advancement of Science

Acid Rain on Acid Soil: A New Perspective

Edward C. Krug and Charles R. Frink

Summary. Acid rain is widely believed to be responsible for acidifying soil and water in areas of North America and northern Europe. However, factors commonly considered to make landscapes susceptible to acidification by acid rain are the same factors long known to strongly acidify soils through the natural processes of soil formation. Recovery from extreme and widespread careless land use has also occurred in regions undergoing acidification. There is evidence that acidification by acid rain is superimposed on long-term acidification induced by changes in land use and consequent vegetative succession. Thus, the interactions of acid rain, acid soil, and vegetation need to be carefully examined on a watershed basis in assessing benefits expected from proposed reductions in emissions of oxides of sulfur and nitrogen.

Acid rain is widely considered one of our most serious environmental problems. In landscapes where hydrology and geochemistry do not allow complete neutralization of acid runoff, acid rain is thought to be acidifying lakes and streams, as well as mobilizing aluminum and other metals toxic to fish and plants. Nutrients are also thought to be depleted by acid rain, raising concern about large areas of productive forests located on soils that are strongly acid and low in nutrients. A gradual acidification and sterilization of our soil and water, particularly in parts of the Adirondacks, northern New England, southeastern Canada, and southern Scandinavia, is predicted.

From its inception, however, soil formation in humid temperature climates is an acidifying process, mediated by the classic factors of geology, climate, biology, topography, and time. Indeed, the factors thought to make landscapes sensitive to acid rain are those that develop some of the most acid soils in the world. The results of natural soil formation are those attributed to acid rain: leaching of nutrients, release of aluminum, and acidification of soil and water.

Landscapes have usually been assumed to act merely as net sinks for acid rain (*1*), but generation of acidity in soils has recently been recognized as an additional source. This is evident in reports of the Norwegian project on "Acid Precipitation—Effects on Forests and Fish" (the SNSF project), for example (*2–4*). However, acid rain is still considered principally responsible for regional acidification (*2–4*), because the increased flux of SO_4^{2-} in rain is thought to result in equivalent leaching of hydrogen ions and other cations. We believe that this assessment needs reexamination. Large amounts of humic acids are present in forested landscapes thought to be particularly sensitive to acid rain. The solubility of these humic acids is controlled by *p*H, and hence they effectively regulate both acidity and anion flux.

In this article we define acidity in relation to rain and soil, describe how soil formation can acidify soil and water as well as leach nutrients and aluminum, show how humic acids buffer soils, and finally discuss the impact of changing land use and consequent vegetational succession. We wish to show that natural soil formation is often more important than acid rain in determining the acidity of lakes and streams.

Acidity of Rain and Soil

Rain in equilibrium with carbon dioxide in the air has a *p*H of about 5.6. Rain at *p*H 4.6 is often said to be ten times more acidic, but this neglects the acidity of undissociated carbonic acid (H_2CO_3) normally present in rain. The strong acid necessary to reduce the *p*H of rain from 5.6 to 4.6 actually represents a twofold rather than a tenfold increase in total acidity (*5*).

The acidity of rain has also been expressed in terms of the amount of limestone, $CaCO_3$, that can be neutralized or leached from the soil (*6*), but the amounts that can be dissolved by rain at *p*H 5.6 are often ignored. An annual rainfall of 1 meter per hectare at *p*H 5.6 can dissolve 400 to 500 kilograms of $CaCO_3$ per hectare, depending on the values of the thermodynamic constants used (*5*). Rain at *p*H 4.6 can dissolve an additional 10 to 12 kg/ha, and rain strongly acidified to *p*H 4 can dissolve an additional 50 kg/ha or about 1 kiloequivalent per hectare. For comparison, managed agricultural soils in the northeastern United States may require limestone additions of 50 to 100 keq/ha per annum.

Measurements of acid in soil are somewhat analogous to measurements of acid in rain. With clay minerals and organic macromolecules acting as immobile anion phases, soils resemble weak acids, making a thermodynamic interpretation of soil *p*H uncertain. However, certain principles apply: increasing concentrations of neutral salt decrease the measured *p*H, whereas increasing dilution with water increases *p*H. This salt effect is significant in measuring acidification of runoff.

The exchange acidity of soil is the analog of the total acidity of rain and is defined in terms of hydrogen ions readily exchanged by neutral salts. Acid humus typically has an exchange acidity of about 1 eq/kg, which is about 10,000 times greater than its acidity expressed as *p*H. In mineral soils, much exchange acidity is produced by hydrolysis of ionic aluminum. Hence, at *p*H values that are typical of strongly acid soils, ion exchange sites on minerals are occupied primarily by ionic aluminum and some additional aluminum is complexed by organic matter, giving a total exchange acidity on the order of 1000 keq/ha.

Soil Formation

The more mature a soil is the more it differs from its parent material, although the degree of difference is strongly influenced by geology. In humid temperate climates soils are more acid than their parent materials: water percolating through freshly ground granite is alkaline (*p*H 8 to 9), but soils developed from granite are acid. There is sufficient acidification that mature soils developed even on limestone or marble can be acid (*7*).

Edward C. Krug is an assistant soil scientist in the Department of Soil and Water, The Connecticut Agricultural Experiment Station, New Haven 06504. Charles R. Frink is chief of the Department of Soil and Water and vice director of The Connecticut Agricultural Experiment Station.

Although chemical oxidation of reduced elements in parent materials produces acidity, it cannot account for the extremely acid podzols and related peats found on granite-like rocks. Acidification of these soils is biological (*8*); hence, the soils are most acid at the surface, where most decomposition and leaching occurs.

The major sources and sinks of soil acidity are illustrated in Fig. 1. Initially, weathering of freshly exposed siliceous bedrock is rapid and bases such as calcium, magnesium, potassium, and sodium are leached (pathway 3d in Fig. 1). Acid is generated by the biological oxidation of carbon, nitrogen, and sulfur, much as acid rain is created by the burning of fossil fuels. Because the partial pressure of CO_2 in soils can be 100 times that in the air, potential weathering rates by H_2CO_3 are immense, although seldom achieved in nature. Reaction and removal of hydrogen ions favor continued dissociation to H^+ and HCO_3^- (pathway 2c). With time, rates of acid neutralization, weathering, and cation denudation decrease and acids accumulate. Little H_2CO_3 is consumed by mineral weathering; most of it is lost as CO_2 and H_2O (pathway 2c). This is reflected by the low bicarbonate alkalinity of runoff from watersheds with strongly acid soils.

A layer of humus eventually forms which often lies over bleached mineral soil. Earthworms and other organisms that mix litter with mineral soil are now absent, and microbial populations have changed. Production of simple organic acids is slight, but production of partially oxidized humic acids of high molecular weight is favored (*9*). These humic acids more strongly acidify their environment than the final oxidation products of CO_2 and H_2O. The increased acidity decreases the solubility of humic acids (*10*), and enhances their accumulation. The rate of mineral weathering is now exceedingly low, most organic acids are lost as CO_2 and H_2O, and the upper mineral soil is a highly weathered siliceous residue resistant to acid weathering. This process is known as podzolization, and soils with distinctive bleached horizons are known as podzols.

It is often thought that acid humus accumulates because organic matter decomposes slowly. This is clearly true where thick peat develops under sparse vegetation. It is not true for the productive forests on podzolized acid soils in the Northeast, southeastern Canada, and Scandinavia (*11*), where concern about acid rain is greatest.

Formation of mature podzol soils from freshly exposed materials is measured in thousands of years, because the capacity of the parent material to neutralize acid is great relative to rates of weathering. For example, the potential for neutralization of acids by the parent material at Hubbard Brook in New Hampshire is nearly 21,000 times greater than the yearly inputs of acid rain and 11,000 times greater than the estimated rate of mineral weathering (pathways 3a to 3d in Fig. 1) (*12*). In addition, the aluminum oxides in the parent material neutralize acid in water (pathway 3c) when the *p*H is below 5 and serve as an enormous sink against acidification (*13*).

Although some preferential flow occurs in soils, so that not all ion exchange sites can react equally with leachate, the time scale of weathering allows distinctive soil horizons to develop parallel to the earth's surface rather than surrounding vertical channels of preferential flow. Given the rate of soil formation, or even the 100 or more years said to be necessary for significant leaching of cations by acid rain (*14*), strong acidification of mineral soil is generally restricted to the upper soil profile. In addition, the earth's surface is not stable: erosion, tree throw, frost heaving, and soil creep constantly expose new and less weathered mineral material. Although the amounts of soil moved are small, the corresponding resistance to acidification is large. Only where weathering can keep pace with disturbance do we see mature, albeit heterogeneous, soil development.

Acidification of Soil and Water

Because cation exchange reactions are rapid, hydrogen ions in acid rain could rapidly acidify soil by depleting exchangeable base nutrients. If increases in H^+ in acid rain (ΔH) leached nutrient cations (ΔM) from soils on a charge-equivalent basis (that is, $\Delta M/\Delta H = 1$), strongly acid soils would be highly susceptible to acidification because of their low nutrient content. However, the ability of hydrogen ions to remove nutrient cations from soils more acid than *p*H 5 is low; that is, $\Delta M/\Delta H \ll 1$ at the mean *p*H of present-day acid rain (*15*). Conversely, base nutrient cations are efficiently retained. Data on acid soils and acid rain in areas of concern around the world show that, on average, the proportion of bases to acid in the rain is usually equal to or greater than that in the strongly acid forest soils on which the rain falls (*15–17*).

Artificial leaching experiments, some

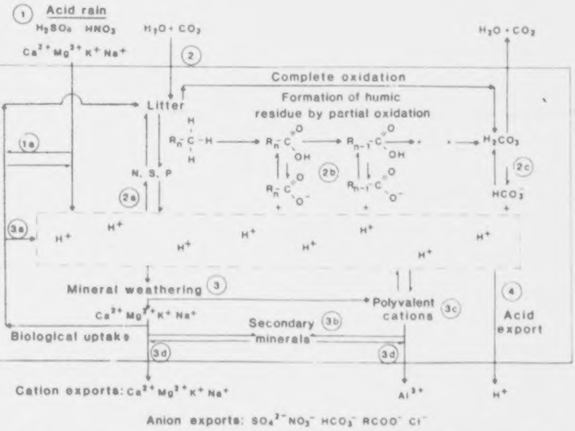


Fig. 1. Major sources and sinks of acidity in soil. Acid rain (1) is a source of acidity, but its composition may be altered before reaching the soil (1a). Although biological processes (2) are net sources of acidity, this obscures the fact that they serve as a substantial sink in acid soils through the production of weak organic acids (2b), which are ultimately converted to CO_2 and H_2O (2c). Mineral acids (2a) can be cycled rather tightly, with some sulfur and nitrogen lost to the atmosphere and some sulfur and phosphorus converted to solid phases. Weathering of minerals (3) generally consumes acid in excess of cation export (3d), as secondary minerals (3b) and hydrolysis products of aluminum, iron, and manganese (3c) accumulate in soil. Aggrading vegetation results in net cation uptake (3a) and can contribute to acidification. Rain which is less acid than the soil solution can also be acidified by hydrolysis (3c). Cation (3d) and acid (4) export is charge-balanced principally by anions shown at the bottom.

of which have lasted up to 5 years, verify that acid rain at *p*H 4 or higher is inefficient in replacing base cations from podzols and related acid soils (*2–4*, *18*). As soil *p*H increases above 5, base cations are replaced more efficiently. Thus, the less acid soils with low cation exchange capacity developed on coarse siliceous materials are actually more susceptible to acidification (*15*). Little research has been conducted on the impact of acid rain on such soils (*19*).

Bicarbonate alkalinity is the principal measure of the ability of lakes to resist acidification. In highly siliceous watersheds with acid soils where rates of mineral weathering by H_2CO_3 are low, inputs of HCO_3^- per unit drainage area are also low. Lakes in such watersheds with small ratios of drainage area to lake area could be acidified by acid rain falling directly on them. Little change in *p*H will occur until 80 to 90 percent of the bicarbonate has been neutralized (*20*). One lake in Canada that occupies about 40 percent of an entire watershed has apparently been directly acidified by acid rain (*21*). However, this direct acidification is usually considered a minor factor relative to acid runoff (*2–4*, *20*, *22*).

Alpine-like lakes and streams in granitic terrain are believed to be especially vulnerable, particularly where there is little mineral soil and permeable geologic material to neutralize runoff from acid rain. Also, the relatively steep and short slopes of these landscapes minimize infiltration and time of contact with neutralizing minerals. The granitic shield and similar areas of eastern North America and northern Europe also have large proportions of extremely acid peats with only small amounts of weatherable minerals (*1*, *20*, *23–26*). Because these peats often border lakes and streams, they can exert a disproportionately large influence on water chemistry (*25*, *26*). For example, acid peats cover 24 percent of a watershed in southernmost Norway, and 62 percent of the drainage flows through them (*26*).

The factors thought to make these landscapes sensitive to acid rain also limit neutralization of runoff acidified by acid soil. The thin and rocky soils that develop on these areas naturally produce such thick humus that they are often classified as organic soils (*17*, *24*, *27–31*), and they have a lower *p*H than the thicker soils downslope (*27*, *31–33*). This topographic gradient in soil chemistry and other properties, where the upland soils are "leaky" and act as A horizons and the lower-lying sites act as B horizons, is known as a geochemical soil catena (*34*). Thus, a gradient in stream acidity paralleling a soil catena in mountainous areas should not be surprising, although it is not always evident. Such gradients have been observed at Hubbard Brook and other mountainous watersheds in the northeastern United States, but the acidification has been attributed entirely to acid rain (*35*, *36*).

The interim report of the SNSF project attributed acid runoff solely to acid rain (*1*). This evoked criticism from other Scandinavian scientists, who noted that the amounts of acid in soils are enormous relative to that in rain and that runoff from acid soils will be acid regardless of the *p*H of rain (*37*, *38*). They suggested that in such watersheds, runoff from heavy rains and rapid snowmelts is acidified because a greater proportion is in contact with the most acid surface soil horizons. Thus, hydrologic factors can make rapid runoff significantly more acid than runoff from gentler rains or slower snowmelts, which percolate to a greater depth and more slowly through less acid subsoil and geologic materials. In short, the effects of acid rain were said to be confused with those of acid soil (*37*, *38*).

A later report of the SNSF project acknowledged that soils can act as both sources and sinks for acid and that the effects of acid rain were not clearly expressed even in watersheds as small as 10 ha (*39*). Accordingly, "minicatchments" ranging in size from 0.003 to 0.026 ha were established. Because of their small size, shallow soil, and large areas of exposed bedrock (46 to 74 percent), these catchments represent a worst case where the effects of acid rain should be most evident (*39*).

On average, runoff in the minicatchments was twice as acid as the acid rain, and the *p*H of the runoff was correlated with soil *p*H. Only for the heaviest rains in the smaller basins was the *p*H of rain found to measurably affect the *p*H of runoff (*39*). There was essentially no difference in acidity between the snowmelt from a snowpack at *p*H 4.3 and that from a snowpack neutralized to about *p*H 7 (*40*). Artificial rain at *p*H 3.85 acidified runoff by 0.2 to 0.4 *p*H unit, but it was concluded that further studies were needed to determine whether such acid rain can measurably acidify runoff in larger watersheds (*41*).

Although it has been demonstrated that acid soils can acidify runoff, it is still contended that acid rain is the major factor in the acidification of leachate and runoff. We believe that this is due to a number of misconceptions. One of them concerns anion leaching. As we noted earlier, hydrogen ions in acid rain at *p*H 4 or greater are inefficient in exchanging bases and thereby in acidifying strongly acid soils. Accordingly, most of the hydrogen ions in rain are thought to remain in solution and move through the soil accompanied by sulfate as the principal anion (*2–4*, *20*, *22*, *42*). Sulfur in rain generally exceeds the nutrient requirements of forests, and humic materials coat aluminum and iron oxides that might otherwise immobilize sulfate by anion fixation (*1*, *2–4*, *20*, *42*, *43*). Thus, most of the H_2SO_4 falling on these soils is thought to move through them, causing increased cation leaching proportional to the increased flux of SO_4^{2-}. Similarly, acid peats are considered to offer little resistance to acidification of runoff by acid rain (*1*, *2–4*, *20*, *26*).

However, the anion leaching theory has a major flaw. Watersheds considered to be most sensitive to acid rain have soils that are strongly acid and rich in humus, and their chemistry is not one of simple ion exchange. Humic materials act as weak acids; they dissolve in water and color and acidify it. The solubility of humic materials is a function of *p*H; the more acid the water, the less is dissolved (*10*). Sulfate apparently does not react strongly with humic materials, but the added H^+ in acid rain hinders their dissociation and decreases their solubility (*10*). The response is analogous to that of an inorganic system containing an excess of a sparingly soluble solid phase. Thus, additions of H_2SO_4 in rain should increase the flux of SO_4^{2-} and decrease the flux of organic anions with little or no measurable change in *p*H (*44*). Organic acids that accumulate are fated to be oxidized to CO_2 and H_2O.

Such a buffering mechanism helps explain why acid rain does not increase cation leaching in strongly acid soils at rates equivalent to deposition (*18*, *45*). Rates of cation export from watersheds in the northeastern United States, Canada, and Norway which are thought to be sensitive to acid rain are remarkably low (*1*, *35*, *46–49*). Investigators at Hubbard Brook found it perplexing that the rate of cation export from the watershed was unusually low and apparently not enhanced by acid rain (*49*). Johnson (*35*) reported that "geologically, no excessive chemical weathering activity [as measured by cation export from watersheds] can be attributed to acid rain over the northeastern United States."

Other researchers state that the strong acids in acid rain result in equivalent leaching of cations (*1*, *46–48*), but this conclusion is not supported by their own data. For example, rates of loss of cations in rivers in Canada are lowest where inputs of acid rain are highest (*47*). If the assumption of equivalent leaching were strictly applied to Norwegian data there should be no net loss of cations without acid rain, because net losses of cations are equivalent to inputs of acid in acid rain (*1, 48*).

The organic acid buffering mechanism also offers an alternative explanation of the observation that humic-colored lakes in Scandinavia are becoming clearer, an effect previously attributed to precipitation of humic acid by iron and aluminum dissolved by acid rain (*50*).

Leaching of Aluminum

The presence of aluminum ions in solution in soil and water at *p*H 5 or less has been considered evidence of dissolution of aluminum by acid rain (*1, 43, 51*). Even though it has long been known that large amounts of soluble aluminum are present in acid soils, the discovery of leaching of soil aluminum by acid rain (*43*) has been described as a principal and historic contribution (*52*). The discovery was based on the observation that there is considerably less aluminum mobilization in "pristine" sites in New Mexico and Washington than in "polluted" sites at Mount Moosilauke in New Hampshire. This is not surprising, however, since the soils in New Mexico and Washington are naturally less acid than those in New Hampshire (*53*).

There is a further misconception that aluminum leached from the A horizon of podzols is normally immobilized in the B horizon, and hence that aluminum in leachate which has moved through the B horizon must have been dissolved by acid rain. Such movement of aluminum out of soils is implicit in the concept of the geochemical soil catena (*34*). Some aluminum is leached and may appear in surface waters, as shown in 1930 by Joffe and later by others (*54, 55*). Indeed, at the sites in Washington examined by Ugolini and co-workers (*53*) one-third to one-half of the aluminum from the A horizon remains in solution in the B horizon. Aluminum does not appear in nearby spring water because it is precipitated as the water moves through fractured basic andesite bedrock. In New Hampshire, on the other hand, the water moves rapidly over solid bedrock, and hence aluminum appears in adjacent spring water.

The belief that aluminum ions in water result from acid rain is supported by the idea that all aluminum leached from organic-rich soils is complexed by organic anions. In humic-rich soils at *p*H 4.5 to 5, humic materials do complex most of the aluminum, as shown 50 years ago (*56*). However, aluminum complexation decreases dramatically as the *p*H decreases below about 4.5. Likewise, the solubility and mobility of complexed aluminum decrease as acidity increases (*10, 57*). Accordingly, ionized aluminum should be expected in water draining from organic-rich soils at *p*H 4 or less. This may also help explain why more aluminum is leached from the upper soil horizons at the Washington sites at *p*H 4.5 to 4.7 than at the New Hampshire site at *p*H 4 (*43, 53*).

Basic cations in rain may also promote exchange of ionized aluminum from acid soil into leachate and runoff. Indeed, the data from the snowmelt study mentioned earlier suggest that sodium in the neutralized snowpack replaced aluminum on exchange sites, which increased the concentration of aluminum in runoff for several weeks to about twice that in corresponding runoff from the snowpack with *p*H 4.3 (*40*). Acid rain may also increase the concentrations of base cations in forest throughfall. For example, about 90 percent of the hydrogen ions in acid rain at Hubbard Brook are neutralized in the northern hardwood canopy during the growing season; *p*H 4.1 rain becomes *p*H 5.0 throughfall (*58*). Although these leached nutrient cations are apparently taken up by the forest (*59*), the effects on aluminum chemistry are not known. Future studies should be carefully designed so that ion exchange by neutral salts (the salt effect) is not confused with dissolution of aluminum by acid (*60*).

Effects of Changing Land Use

Both regional acid rain and drastic changes in land use are associated with societal and technological evolution. Earlier, the exploitation of temperate forests was widespread and highly destructive. The remaining forests of western Europe all show the influence of man (*61*). The extensive heaths of Great Britain, Scandinavia, and northern Europe are the consequences of earlier and careless land use (*62*). Several thousand years of burning, grazing, and cutting caused severe erosion, which helped to create the unusually thin soils and low treelines of the uplands and low mountains of southern Norway (*2, 38, 63*). Many of these practices were transported to eastern North America with the arrival of the Europeans more than three centuries ago.

Fortunately, the temperate forests in Europe and North America were sufficiently resilient that they are now recovering. In New England, the volume of standing wood has increased by about 70 percent between 1952 and 1976 (*64*). Worldwide, temperate forest regrowth is so great that it may influence the global carbon cycle (*62, 65*). Given the effects of vegetation on soil acidification, there is little doubt that recovery of landscapes from earlier disturbance can result in increasingly acid surface soil horizons and thickening and acidification of forest floors.

In the 1920's, Salisbury (*32*) demonstrated that successional change and forest recovery from previous exploitation were responsible for widespread acidification of British landscapes; the upper slopes, with their acidophilic vegetation, were shown to be undergoing the greatest acidification. Large-scale recovery of forests in New England stimulated early studies in Connecticut. Red pine planted in 1900 on abandoned corn and tobacco fields developed a forest floor with a *p*H of about 3.8 (*66*). Other plots were established in 1926 and 1927 in 20- to 40-year-old hardwood stands and have been protected from cutting and burning. Our measurements show that today hardwoods have acidified the forest floor at one site from about *p*H 5.5 to 3.9 and the underlying mineral soil from *p*H 5.1 to 4.6 (*67*). At another site there was almost complete mortality of oak from drought and defoliation. Basal area declined from 30.5 m^2/ha in 1957 to 4.6 m^2/ha in 1977. Here, we found that the *p*H of the forest floor had actually increased from 3.8 to 4.2 (*67*).

While soil properties and effects of changing land use vary from site to site and are even heterogeneous within sites some general relations are evident. Land use and forest management studies in North America and northern Europe reveal that disturbance under conifers affects acidity and depth of humus more than similar disturbance under hardwoods (*28, 29, 54, 68, 69*). Likewise, the greater the disturbance, the greater the effect. Mixed hardwood-conifer forests are intermediate, but their response to disturbance tends to resemble that of conifers (*28, 29, 54, 68–70*). Thus, as Salisbury (*32*) concluded, recovery from earlier disturbance will have its greatest effects on the upper slopes—that is, on strongly acid soils rich in organic matter.

In the northeastern United States, the most severe changes have occurred in the spruce-fir forests of northern New England and on the steep slopes of the Adirondacks, where acid rain is thought to be particularly harmful. By the early 1900's essentially all the spruce-fir forests had been clear-cut for pulp, except for a small fraction of the forest in the Adirondacks which was preserved (*30, 71–73*). The original spruce-fir forests were very resistant to fire (*72, 74*), but lumbering was often followed by severe fires that largely or completely destroyed the thick forest floor (*28–30, 73, 75*).

The more intense a forest fire, the greater the effects on depth and acidity of the forest floor. Organic acids are oxidized and lost to the atmosphere, leaving alkaline ash on the soil (*28, 29, 54, 68, 69*). In managed spruce forests in Scandinavia, where controlled burning reduced the depth of humus by only 1 cm, the *p*H of the remaining 4 cm of humus rose 2 to 3 units. After 50 years the original depth of humus was restored, as was the original *p*H of 4. The *p*H of the upper mineral soil was still elevated by about 0.2 *p*H unit (*69, 76*).

The depth of the forest floor under undisturbed stands of spruce and fir on the upper slopes of the Adirondack, White, and Laurentian mountains commonly exceeds 30 cm and the *p*H is less than 3.5 (*27–31*). Diebold (*28*) showed that in the Adirondacks, fire in spruce-fir slope forests is more destructive to the forest floor than in other forest types (*28, 29, 68, 69, 75*). On the average, the depth of the forest floor up to 30 years after burning was reduced by 30 cm. The thinner and less acid forest floors of the lower slopes and valleys were reduced by 5 to 13 cm (*27–31*).

On the steeper slopes of the White Mountains the depth of the forest floor ranges from discontinuous to 5 to 10 cm (*77*), suggesting widespread destruction of the original forest floor. The depth of the forest floor may also be reduced in the absence of fire: in cutover but unburned Adirondack spruce forests the floor averages about 5 cm in depth (*78*).

The effect of cutting and burning on the *p*H of the forest floor on the steep slopes of the Adirondacks has apparently not been determined. In the various forest types of the lower slopes and valleys, Young [in (*68*)] showed reductions in the depth of the forest floor from both cutting and burning that were similar to those reported by Diebold (*28*). The *p*H of the forest floor averaged about 4 in undisturbed stands, but under stands that were cut or burned the average *p*H was about 5 when measured 20 to 50 years after disturbance. The *p*H of the mineral soil averaged about 0.7 unit higher under disturbed stands.

Maturation of forests also influences hydrology. As the depth of humus increases, the amount of water percolating into the subsoil may decrease (*79*). Runoff can become more acid not only because of the increasingly acid humus, but also because of the increasing proportion of near-surface runoff. Also, snowpacks last longer under older forests, making episodic flushes more likely during periods of warm weather or rainfall (*80*). The devastating effects of spring snowmelt may be more severe in part because of changes in hydrology and chemistry induced by changes in the forest.

Although the effects of forest disturbance and recovery are variable, it is apparent that recovery results in increasingly acid soil horizons and thickening organic horizons (*28, 29, 54, 68, 69*). Accordingly, water moving through such soil should also become more acid, and the proportion of ionized aluminum to organically complexed aluminum may also increase (*57*).

Thus, mountainous areas of the northeastern United States are not pristine environments that are acted on only by acid rain. These landscapes, which were disturbed in the past, are undergoing the soil formation process that produce the greatest increases in natural soil acidity.

The idea that changing land use and consequent vegetational succession are largely responsible for acidification of soil and water in southern Norway was first advanced by Rosenqvist (*38*). Forest recovery in southernmost Norway has been dramatic; the volume of standing wood increased by more than 70 percent during the period 1927–1928 to 1964–1973. Rosenqvist proposed that this large-scale recovery of forest and the reversion of land to acid heath and forest was producing large areas of increasingly acid soils. As an illustration, he showed that the exchange acidity of surface humus under a 90-year-old spruce forest on an abandoned Norwegian farm was equivalent to the strong acids in about 1000 years of rain of ½ m per year with *p*H 4.3. He proposed that these increasing amounts of increasingly acid humus and mineral soil (*81*) are acidifying runoff in watersheds where there is incomplete neutralization of acids by mineral weathering (*38, 63*).

The final report of the SNSF project acknowledges that changes in land use and consequent vegetative succession have long been known to acidify soil and will in general affect the alkalinity and *p*H of rivers and lakes (*2–4*). Nevertheless, it considers changes in land use to be a minor factor and concludes that the observed increases in sulfate in runoff and presumed equivalent increases in leaching of hydrogen, aluminum, and other cations are responsible for most of the observed increases in acidity (*2–4*).

We believe that the effects of changing land use and vegetative succession cannot be dismissed on the basis of studies performed to date. Further, the hypothesis that increased deposition of acid and sulfate is causing equivalent leaching and acidification is theoretically unsound and is not supported by direct observations. Natural processes of acidification must be more carefully considered in assessing benefits expected from proposed reductions in emissions of oxides of sulfur and nitrogen.

References and Notes

1. F. H. Braekke, Ed., *SNSF Proj. Res. Rep. FR 6/76* (1976).
2. L. N. Overrein, H. M. Seip, A. Tollan, Eds., *SNSF Proj. Res. Rep. FR 19/80* (1980).
3. D. Drablos and A. Tollan, Eds., *Ecological Impact of Acid Precipitation* (SNSF Project, Oslo, 1980).
4. H. M. Seip, *ibid.*, p. 358.
5. W. Stumm and J. J. Morgan, *Aquatic Chemistry* (Wiley-Interscience, New York, 1970), p. 161; R. M. Garrels and C. L. Christ, *Solutions, Minerals, and Equilibria* (Harper & Row, New York, 1965), p. 74.
6. G. E. Likens, F. H. Bormann, R. S. Pierce, J. S. Eaton, N. M. Johnson, *Biogeochemistry of a Forested Ecosystem* (Springer-Verlag, New York, 1977), p. 43.
7. H. A. Lunt, *Conn. Agric. Exp. Stn. New Haven Bull. 523* (1948); R. D. Krebs and J. C. F. Tedrow, *Soil Sci.* **83**, 207 (1957); D. M. J. Provan, R. Sorensen, J. Lag, *Meld. Nor. Landbrukshoegsk.* **48** (No. 22) (1969).
8. S. Mattson, *K. Lantbrukshoegsk. Ann.* **5**, 261 (1938); H. Jenny, *Factors of Soil Formation* (McGraw-Hill, New York, 1941); P. W. Birkeland, *Pedology, Weathering, and Geomorphological Research* (Oxford Univ. Press, New York, 1974); N. van Breemen and R. Brinkman, in *Soil Chemistry*, part A, *Basic Elements*, G. H. Bolt and M. G. M. Bruggenwert, Eds. (Elsevier, New York, 1978), p. 141.
9. S. Mattson and E. Koutler-Andersson, *K. Lantbrukshoegsk. Ann.* **13**, 153 (1946); M. Schnitzer and J. G. Desjardins, *Can. J. Soil Sci.* **49**, 151 (1969).
10. M. H. B. Hayes and R. S. Swift, in *The Chemistry of Soil Constituents*, D. J. Greenland and M. H. B. Hayes, Eds. (Wiley-Interscience, New York, 1978), p. 281; K. Ghosh and M. Schnitzer, *Soil Sci.* **129**, 266 (1980); G. S. P. Ritchie and A. M. Posner, *J. Soil Sci.* **33**, 233 (1982). Most soil humic substances are in a solid or gel state. Polar functional groups and charged sites with their counterions will be strongly solvated in water. Electrostatic repulsion between like charges of dissociated groups is required for dissolution of humic fraction. Replacement of readily dissociated counterions by H^+ gives rise to contraction and precipitation of humic substances by reduction of charge repulsion between weakly dissociated carboxyl groups, enhanced hydrogen bonding, and expulsion of solvent from within the macromolecular humate structure.
11. L. G. Romell, *Soil Sci.* **34**, 161 (1932).
12. Acid to dissolve minerals is calculated from the average composition of Hubbard Brook geologic materials [N. M. Johnson, G. E. Likens, F. H. Bormann, R. S. Pierce, *Geochim. Cosmochim. Acta* **32**, 531 (1968)], assuming a 0.6-m slice weighs 8.82×10^6 kg/ha. The depth of 0.6 m is used since sola of well-developed soils in the Northeast are about 0.6 m. Acid neutralizing capacity of Al is three times that of bases. Rates of acid deposition and mineral weathering were estimated by C. T. Driscoll and G. E. Likens [*Tellus* **34**, 283 (1982)].
13. N. M. Johnson, paper presented at the American Chemical Society National Meeting, Las Vegas, Nev., 28 March to 2 April 1982.
14. W. W. McFee, J. M. Kelly, R. H. Beck, *U.S. For. Serv. Gen. Tech. Rep. NE-23* (1976), p. 725. These authors stated that their calculations were based on simplifying assumptions that may not hold, namely that (i) hydrogen is the only cation in rain, (ii) replacement of basic cations

by hydrogen is complete ($\Delta M/\Delta H = 1$), (iii) no hydrogen is consumed by other mechanisms, and (iv) no basic cations are supplied by other mechanisms.

15. L. Wiklander, *Grundfoerbaettring* **26**, 155 (1973/74); *Geoderma* **14**, 93 (1975).
16. F. J. Pearson and D. W. Fisher, *U.S. Geol. Surv. Water Supply Pap. 1535-P* (1971); S. Odén, *U.S. For. Serv. Gen. Tech. Rep. NE-23* (1976), p. 1; P. M. Vitousek, J. R. Gosz, C. C. Grier, J. M. Melillo, W. A. Reiners, *Ecol. Monogr.* **52**, 155 (1982).
17. J. S. Clayton, W. A. Ehrlich, D. B. Cann, J. H. Day, I. B. Marshall, *Soils of Canada* (Canadian Department of Agriculture, Ottowa, 1977), vol. 1.
18. A. O. Stuanes, in (*3*), p. 198; I. K. Morrison, *Can. For. Serv. Res. Notes* **1**, 6 (1981); L. N. Overrein, *Ambio* **1**, 145 (1972); W. H. Smith, *Air Pollution and Forests* (Springer-Verlag, New York, 1981), p. 187.
19. D. D. Richter *et al.*, in *Proceedings of the Second National Symposium on Acid Rain* (Greater Pittsburgh Chamber of Commerce, Pittsburgh, Pa., October 1982).
20. National Research Council, *Atmosphere-Biosphere Interactions: Toward a Better Understanding of the Ecological Consequences of Fossil Fuel Combustion* (National Academy Press, Washington, D.C., 1981).
21. P. J. Dillon *et al.*, *J. Fish. Res. Board Can.* **35**, 809 (1978).
22. New York State Department of Environmental Conservation, *Proceedings of the Acid Precipitation Research Needs Conference* (State University of New York, Syracuse, 1982).
23. N. S. Shaler, in *Tenth Annual Report of the United States Geological Survey* (Government Printing Office, Washington, D.C., 1890), p. 255; G. B. Rigg, *Bot. Rev.* **6**, 666 (1940); R. S. Farnham and H. R. Finney, *Adv. Agron.* **17**, 115 (1965).
24. F. H. Braekke, *Medd. Nor. Skogforsoeksves.* **36** (No. 11) (1981).
25. A. G. Everett, W. C. Retzsch, J. R. Kramer, I. P. Montanez, P. F. Duhaime, in *Proceedings of the Second National Symposium on Acid Rain* (Greater Pittsburgh Chamber of Commerce, Pittsburgh, Pa., October 1982).
26. F. H. Braekke, *Medd. Nor. Skogforsoeksves.* **36** (No. 10) (1981).
27. C. C. Heimburger, *Cornell Univ. Agric. Exp. Stn. Mem. 165* (1934).
28. C. H. Diebold, *Soil Sci. Soc. Am. Proc.* **6**, 409 (1941).
29. H. J. Lutz and R. F. Chandler, *Forest Soils* (Wiley, New York, 1946), p. 183.
30. H. J. Oostings and W. D. Billings, *Ecology* **32**, 84 (1951).
31. T. G. Siccama, thesis, University of Vermont (1968); H. L. Bohn, *Soil Sci. Soc. Am. J.* **40**, 468 (1976).
32. E. J. Salisbury, *J. Ecol.* **9**, 220 (1922).
33. E. T. Wherry, *Ecology* **4**, 395 (1923); S. A. Cain, *Bot. Gaz.* **91**, 22 (1931); L. F. Ohmann and M. F. Buell, *Bull. Torrey Bot. Club* **95**, 287 (1968); T. G. Siccama, *Ecol. Monogr.* **44**, 325 (1974); T. Troedsson, *Ann. Agric. Fenn.* **19**, 81 (1980).
34. M. A. Glazovskaya, *Trans. 9th Int. Congr. Soil Sci.* **4**, 303 (1968).
35. N. M. Johnson, *Science* **204**, 497 (1979).
36. N. M. Johnson *et al.*, *Geochim. Cosmochim. Acta* **45**, 1421 (1981).
37. J. Låg, in *Fresh Water on the Sea*, S. Skreslet, R. Leinebø, J. B. L. Matthews, E. Sakshaug, Eds. (Association of Norwegian Oceanographers, Oslo, 1976), p. 21.
38. I. T. Rosenqvist, *Sci. Total Environ.* **10**, 39 (1978).
39. H. M. Seip, G. Abrahamsen, E. T. Gjessing, A. Stuanes, *SNSF Proj. Int. Rep. IR 46/79* (1979).
40. H. M. Seip, S. Andersen, B. Halsvik, *SNSF Proj. Int. Rep. IR 65/80* (1980).
41. H. M. Seip, E. T. Gjessing, H. Kamben, *SNSF Proj. Int. Rep. IR 47/79* (1979).
42. D. W. Johnson, J. Turner, J. M. Kelly, *Water Resour. Res.* **18**, 449 (1982).
43. C. S. Cronan and C. L. Schofield, *Science* **204**, 304 (1979).
44. This hypothesis has been verified, at least in part, by J. G. McColl, B. A. Browne, and M. K. Firestone [in *Agronomy Abstracts* (American Society of Agronomy, Madison, Wisc., 1982), p. 178] and F. H. Chang and M. Alexander (*Soil Sci.*, in press), who showed that acid additions up to *p*H 3 do not measurably acidify leachate and generally decrease organic leaching. P. J. Isaacson and E. C. Krug (unpublished data) found similar buffering by organic acids.
45. G. Abrahamsen, in (*3*), p. 196; _____ and A. O. Stuanes, *ibid.*, p. 152.
46. J. N. Galloway, C. L. Schofield, G. R. Hendrey, E. R. Altwicker, D. E. Troutman, in (*3*), p. 254; J. N. Galloway, C. L. Schofield, G. R. Hendrey, N. E. Peters, A. H. Johannes, *ibid.*, p. 264.
47. M. E. Thompson, F. C. Elder, A. R. Davis, S. Whitlow, *ibid.*, p. 244.
48. R. F. Wright and M. Johannessen, *ibid.*, p. 250.
49. N. M. Johnson, R. C. Reynolds, G. E. Likens, *Science* **177**, 514 (1972).
50. B. Almer, W. Dickson, C. Ekstrom, E. Hornström, in *Sulfur in the Environment*, part 2, *Ecological Impacts*, J. O. Nriaga, Ed. (Wiley-Interscience, New York, 1978), p. 271; W. Dickson, in (*3*), p. 75.
51. R. F. Wright *et al.*, *SNSF Proj. Res. Rep. FR 3/75* (1975); W. Dickson, *Verh. Int. Ver. Limnol.* **20**, 851 (1978).
52. E. B. Cowling, *Environ. Sci. Technol.* **16**, 110A (1982).
53. M. C. Hoyle, *U.S. For. Serv. Res. Pap. NE-260* (1973); F. C. Ugolini, H. Dawson, J. Zachara, *Science* **198**, 603 (1977); F. C. Ugolini, R. Minden, H. Dawson, J. Zachara, *Soil Sci.* **124**, 291 (1977); W. C. Graustein, thesis, Yale University (1981).
54. O. Tamm, *Northern Coniferous Forest Soils* (Scrivener, Oxford, 1950), p. 144.
55. J. S. Joffe, *Proc. 2nd Int. Congr. Soil Sci.* **2**, 135 (1930); A. A. Rode, *Soil Science* (Department of Commerce, Washington, D.C., 1962), p. 155; L. Petersen, *Podzols and Podzolization* (DSR Forlag, Copenhagen, 1976); E. C. Krug, thesis, Rutgers University (1981).
56. S. Mattson and J. B. Hester, *Soil Sci.* **36**, 229 (1933).
57. K. Boratyński and S. Mattson, *K. Lantbrukshoegsk. Ann.* **7**, 63 (1939); J. van Schuylenborgh and M. G. M. Bruggenwert, *Neth. J. Agric. Sci.* **13**, 267 (1965); M. Schnitzer and F. H. Hansen, *Soil Sci.* **109**, 333 (1970); W. L. Hargrove and G. W. Thomas, *Can. J. Soil Sci.* **62**, 571 (1982).
58. J. W. Hornbeck, G. E. Likens, J. S. Eaton, *U.S. For. Serv. Gen. Tech. Rep. NE-23* (1976), p. 597. However, the effect of forest canopy on throughfall acidity is variable, ranging from nearly complete neutralization [Hornbeck *et al.*; D. W. Cole and D. W. Johnson, *Water Resour. Res.* **13**, 313 (1977)] to no net neutralization (*43*) to concentrating acidifying substances in throughfall [B. Ulrich, in *Effects of Acid Precipitation on Terrestrial Ecosystems*, T. C. Hutchinson and M. Havas, Eds. (Plenum, New York, 1980), p. 255].
59. J. S. Eaton, G. E. Likens, F. H. Bormann, *J. Ecol.* **61**, 495 (1973).
60. W. L. Lindsay, M. Peech, J. S. Clark, *Soil Sci. Soc. Am. Proc.* **23**, 266 (1959); C. R. Frink, in *Acid Sulfate Soils*, H. Dost, Ed. (International Institute of Land Reclamation and Improvement, Wageningen, Netherlands, 1973), vol. 1, p. 131.
61. E. L. Stone, *Philos. Trans. R. Soc. London Ser. B* **271**, 149 (1975).
62. T. Bramryd, in *The Global Carbon Cycle: Scope Report 13*, B. Bolin, E. T. Degens, S. Kempe, P. Ketner, Eds. (Wiley, New York, 1979), p. 183.
63. I. T. Rosenqvist, in *Advances in Environmental Science and Engineering*, J. R. Pfafflin and E. N. Ziegler, Eds. (Gordon & Breach, New York, 1980), vol. 3, p. 56.
64. U.S. Forest Service, *Forest Statistics of the U.S., 1977* (review draft, 1978).
65. M. Clawson, *Science* **204**, 1168 (1979); T. V. Armentano and C. W. Ralston, *Can. J. For. Res.* **10**, 53 (1980).
66. C. R. Frink and G. K. Voigt, *U.S. For. Serv. Gen. Tech. Rep. NE-23* (1976), p. 685.
67. H. W. Hicock, M. F. Morgan, H. J. Lutz, H. Bull, H. A. Lunt, *Conn. Agric. Exp. Stn. New Haven Bull. 330* (1931); Connecticut Agricultural Experiment Station, file data. Basal area is the sum of the cross-sectional areas of the trees per unit area of forest.
68. B. G. Griffin, E. W. Hartwell, T. F. Shaw, *Harv. For. Bull. 15* (1930); M. F. Morgan, *Am. Soil Surv. Assoc. Bull.* **12**, 49 (1931); H. A. Lunt, *Conn. Agric. Exp. Stn. New Haven Bull. 342* (1932); M. J. Plice, *Cornell Univ. Agric. Exp. Stn. Mem. 166* (1934); V. A. Young, *Ecology* **15**, 154 (1934); I. F. Ahlgren and C. E. Ahlgren, *Bot. Rev.* **26**, 483 (1960).
69. P. J. Viro, in *Fire and Ecosystems*, T. T. Kozlowski and C. E. Ahlgren, Eds. (Academic Press, New York, 1974), p. 7.
70. R. L. Donahue, *Cornell Univ. Agric. Exp. Stn. Mem. 229* (1940); T. H. Eaton and R. F. Chandler, *ibid. 247* (1942); A. F. Hough, *Soil Sci.* **56**, 19 (1943).
71. W. F. Fox, *U.S. Dep. Agric. Bur. For. Bull. 34* (1902); F. W. Very, *Science* **35**, 31 (1912); R. Marshall, *J. For.* **23**, 173 (1925); H. J. Oosting and J. F. Reed, *Am. Midl. Natur.* **31**, 182 (1944); R. C. Thompson, thesis, Syracuse University (1962).
72. A. K. Chittenden, *U.S. Dep. Agric. Bur. For. Bull. 55* (1905).
73. P. W. Ayres, *U.S. Dep. Agric. For. Serv. Circ. 168* (1909).
74. C. F. Korstian, *Ecol. Monogr.* **7**, 125 (1937); F. H. Bormann and G. E. Likens, *Pattern and Process in a Forested Ecosystem* (Springer-Verlag, New York, 1979), p. 201; T. J. Fahey and W. A. Reiners, *Bull. Torrey Bot. Club* **108**, 362 (1981).
75. R. C. Hawley and A. F. Hawes, *Forestry in New England* (Wiley, New York, 1912), p. 209; A. MacDonald, *J. For.* **23**, 457 (1925); L. S. Minckler, *ibid.* **43**, 349 (1945); H. I. Baldwin, *Bull. Torrey Bot. Club* **104**, 324 (1977).
76. Depth under comparable undisturbed spruce stands is about 10 cm.
77. M. C. Hoyle, *Rep. N.H. For. Notes* (Summer 1965).
78. J. Kittredge and H. C. Belyea, *J. For.* **21**, 784 (1923).
79. J. Låg and O. Einevoll, *Meld. Nor. Landbrukshoegsk.* **34**, 525 (1954); A. H. Knight, R. Boggie, H. Shepherd, *J. Appl. Ecol.* **9**, 633 (1972); R. Boggie and A. H. Knight, *Forestry* **53**, 179 (1980); J. F. Collins and E. Coyle, *J. Soil Sci.* **31**, 547 (1980).
80. H. W. Lull and F. M. Rushmore, *U.S. For. Serv. Northeast. For. Exp. Stn. Stn. Pap. 138* (1960); W. J. Schneider and G. R. Ayer, *U.S. Geol. Surv. Water Supply Pap. 1602* (1961); A. R. Eschner and D. R. Satterlund, *U.S. For. Serv. Res. Note NE-13* (1963); D. R. Satterlund and A. R. Eschner, *Water Resour. Res.* **1**, 397 (1965).
81. In Scandinavia, spruce and pine growing on old farmland can acidify mineral soil from above *p*H 6 to about *p*H 4 within a few decades [W. Dickson, *Inst. Freshwater Res. Drottningholm Rep. 54* (1975)]. Similar rates of acidification have been reported under poplar and alder in the Netherlands [J. van der Burg and H. W. Kolster, *For. Abstr.* **44** (No. 2), 86 (1983)].